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As a result of user comments and in the interest of improving the effectiveness of *Scientific and Technical Aerospace Reports (STAR)* the following modifications have been incorporated in Volume 3:

1. The subject categories have been revised to reflect the expanding coverage in *STAR*.

2. The indexes (subject, corporate source, and personal author) are now printed in upper and lower case for improved readability.

3. The symbol # has been used in the abstract section, the report/accession number index, and the accession/report number index to indicate that a report has been microfiched.

4. A contract number index will be added to each of the cumulative indexes.

5. The semiannual index cumulation will be discontinued. Instead, first, second, and third quarterly indexes will be issued. The fourth quarter index will be included in the annual cumulation.

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The first section of *STAR*, arranged by subject categories, contains informative abstracts and complete bibliographic citations. A second section consists of five indexes: subject, corporate source, author, report/accession number, and accession/report number. Separate cumulative indexes are published quarterly, except for the fourth quarter, which is an annual index. Cumulative indexes also contain a contract number index.

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Scientific and Technical Information Division
National Aeronautics and Space Administration

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VOLUME 3 NUMBER 1

Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N65-10238# Grumman Aircraft Engineering Corp., Bethpage, N.Y.

AERODYNAMIC CHARACTERISTICS AND FLAP LOADS FOR A BLUNT PYRAMIDICAL CONFIGURATION AT MACH 5 AND 8. PART OF AN INVESTIGATION OF HYPERSONIC FLOW SEPARATION AND CONTROL CHARACTERISTICS

William J. Evans and Louis G. Kaufman, II Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Sep. 1964 149 p refs
(Contract AF 33(616)-8130)
(FDL-TDR-64-128; AD-607508)

Six-component force and moment data were obtained for Mach 5 and 8 flows over a blunt pyramidal configuration. The model had a triangular cross section and was composed of two dihedral surfaces and a 70° sweepback delta wing lower surface. Three-component force and moment data were obtained on a remotely controlled trailing edge flap at deflections up to 40°. All three surfaces had trailing edge flaps, and the model was tested with and without canards and a ventral fin. The model was pitched at angles-of-attack between ±54° and sideslip angles between −4° and +14°. For both Mach numbers, the data were obtained for a nominal free-stream Reynolds number, based on model length, of 4.5 million. Selected configurations were tested at other Reynolds numbers between 1.2 and 9.1 million. Author

N65-10296# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.

PARAMETRIC INVESTIGATION OF THE AERODYNAMIC AND AEROELASTIC CHARACTERISTICS OF ARTICULATED AND RIGID (HINGELESS) HELICOPTER ROTOR SYSTEMS Technical Report, Jun. 1962–Oct. 1963

E. R. Wood and A. C. Buffalano Ft. Eustis, Va., Army Transportation Res. Command, Apr. 1964 284 p refs
(Contract DA-44-177-TC-831)
(TRECOM-TR-64-15; AD-607656)

The analysis considers the high-speed, steady-state flight condition, and takes into account the fully coupled flatwise–edgewise–torsional response of the rotor blades. Substantiation for the method is based upon correlation studies with flight-test data from the Lockheed CL-475 rigid-rotor helicopter and Sikorsky's S-58 and S-51 articulated-rotor helicopters. The study has been limited solely to steady-state flight conditions in which control, fuselage attitude, and c.g. have been selected to produce no one-per-rev flapping. It should not be assumed that these flight conditions or the parameters studied are necessarily those most critical to the operation of a rigid- or articulated-rotor helicopter. Calculated performance and one-half peak-to-peak flatwise stresses are shown to give good agreement with flight-measured values at higher airspeeds. It is found that blade twist is a significant variable for control of blade vibratory stresses and rotor performance. The sensitivity of rigid-rotor flatwise and edgewise stresses to change in design of the blade root region is explored. Studies on variation of blade stiffness indicate that outboard blade stiffening is detrimental (on a moment basis) for an articulated blade, whereas inboard stiffening is detrimental for a rigid blade. For compound helicopters, selection of rotor rpm is found to require an important compromise between blade stress and power. Author

N65-10328 Aeronautical Research Council (Gt. Brit.)

8 FT X 6 FT TUNNEL TESTS ON A MODEL OF THE DE HAVILLAND "BLUE STREAK" AT MACH NUMBERS OF 0.80 TO 1.25

A. L. Courtney London, HMSO, 1964 42 p refs Supersedes RAE-TN-AERO-2610; ARC-21756
(ARC-CP-735; RAE-TN-AERO-2610; ARC-21756) HMSO: 8s

Six-component force and moment measurements have been made on a fully representative model of the Blue Streak at Mach numbers of 0.80 to 1.25, body incidences up to 15°, and roll angles up to 90°, to check the static stability characteristics in the transonic speed range. With fins off, the results are free from serious irregularities, and the pitching moment is approximately linear with body incidence about the full-scale center-of-gravity position. With fins on, there is some nonlinearity in pitch, particularly at subsonic speeds. Author

N65-10329 Aeronautical Research Council (Gt. Brit.)

WIND TUNNEL FORCE AND MOMENT INVESTIGATION AT M = 4.3 INTO THE APPLICATION OF VARIOUS DEVICES FOR THE CONTROL OF A CONE-CYLINDER-FLARE CONFIGURATION

B. C. Pecover London, HMSO, 1964 163 p refs Supersedes RAE-AERO-2673, ARC-24810
(ARC-CP-745; RAE-AERO-2673; ARC-24810) HMSO: £1 10s

Measurements have been made in the 11- × 6-in. wind tunnel of the six components of force and moment on a basic cone–cylinder–flare configuration fitted individually with 10 different devices to produce aerodynamic control. In addition, some measurements of three components of force and moment on a flap or panel in the flare tail are given. The controls tested consisted of a tilting nose, tilting flare, nose flap, flare flap, eccentric nose disc, eccentric rear disc, tilting spike, swept spoiler, eccentric ring, and tilting ring. The measurements were made at M = 4.3 and Reynolds number from 1.4 × 10^6 to 5 × 10^6, depending on the configuration. Results are discussed and compared with simple estimates, and the controls are compared with each other. Author

N65-10330 Aeronautical Research Council (Gt. Brit.)
WIND TUNNEL TESTS AT M = 2.0 ON INTERFERENCE EFFECTS BETWEEN INTAKE FLOWS IN A FOUR-ENGINE NACELLE
M. D. Dobson London, HMSO, 1964 44 p ref Supersedes RAE-TN-AERO-2920, ARC-25597
(ARC-CP-753; RAE-TN-AERO-2920; ARC-25597) HMSO: 10s

A model of a rectangular air intake of aspect ratio 8, with all-external compression and a fixed geometry, has been tested at its design Mach number of 2.0 in the 3- × 3-ft wind tunnel. The model contained four side-by-side simulated engine cells, and tests were made to investigate effects on pressure recovery and mass flow in each of the cells for conditions of unequal throttling. Author

N65-10382# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TWIST OF FLOW AND ITS EFFECT ON THE EFFECTIVENESS OF A CURVILINEAR DIFFUSER
V. N. Amelyushkin and M. P. Umanskiy 18 Sep. 1964 12 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), no. 12, 1963 p 18–21
(FTD-TT-64-551/1+2; AD-607308)

The flow-twist effect in the input section of a curvilinear diffuser nozzle was investigated. There were in the flow part of the diffuser, eight longitudinal rigidity ribs mounted at equal distances. This experimental installation offered the possibility of changing the angle of the flow input. The delivery of air was measured by a dynamic pressure tube with a micropressure gage. It was found that the effectiveness of the diffuser with rigidity ribs is considerably lower than the effectiveness of a ribless diffuser in the presence of a flow twist. G.G.

N64-10399*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS FROM MACH 0.22 TO 4.65 OF A TWO-STAGE ROCKET VEHICLE HAVING AN UNUSUAL NOSE SHAPE
John T. Suttles Washington, NASA, Nov. 1964 61 p refs
(NASA-TN-D-2163) OTS Prices: HC $1.50/MF $0.50

This unusual nose consists of a blunted cone followed by a square body segment that terminates in a conical flare. Four fairings are located near the conical nose and on the flat surfaces of the square body segment. The tests were conducted for subsonic, transonic, and supersonic Mach numbers. The angle-of-attack was varied from about −2° to 95° for the subsonic tests, and the angles-of-attack and sideslip were varied from about −6° to 8° for the transonic and supersonic tests. Results are presented showing the variation of the aerodynamic forces, moments, and centers of pressure with Mach number, angle-of-attack, and angle-of-sideslip. Author

N65-10401*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WIND-TUNNEL TEST OF A FULL-SCALE, 1.1 PRESSURE RATIO, DUCTED LIFT-CRUISE FAN
Demo J. Giulianetti, James C. Biggers, and Victor R. Corsiglia Washington, NASA, Nov. 1964 47 p refs
(NASA-TN-D-2498) OTS Prices: HC $1.25/MF $0.50

A fixed blade angle, ducted, tip-turbine-driven fan was investigated as a propulsive cruise device. Results are presented for cruise conditions and for transition conditions to high duct angles. Thrust and longitudinal aerodynamic characteristics are shown for various duct exit areas at duct angles ranging from −4° to +80°, and for forward speeds ranging from 0 to about 180 knots. Duct inlet stall boundaries and representative duct inlet pressure distributions are included. Increases in lift and positive pitching moment accompanied increases in duct angle. Losses in lift and thrust, and reductions of positive pitching moments accompanied duct inlet stall. Inlet flow separation at duct stall was restricted to the lower portions of the inlet. Maximum descent velocities, as limited by duct inlet stall for an airplane assumed to have two ducted lift-cruise fans, varied from approximately 1160 to about 2150 ft/min for various conditions of forward speed, duct angle, and wing loading. Duct exit area variation was effective for maintaining high levels of net thrust with changes in forward speed. Author

N65-10404 Army Missile Command, Huntsville, Ala. Structures and Mechanics Lab.
MODIFIED NEWTONIAN FORCE COEFFICIENT EQUATIONS TO DETERMINE LOADS ON BLUNTED-CONE STRUCTURE IN THREE-DIMENSIONAL HYPERSONIC FLOW
J. R. Sandlin 10 Jun. 1964 33 p refs
(RS-TR-64-1; AD-450994)

Modified Newtonian aerodynamic forces for blunted cones are developed in a form that is readily usable for structural design and evaluation. The accuracy and reliability of the results of this approximate solution are substantiated through the comparisons presented herein, with available, applicable, experimental force and pressure data. Author

N65-10450 Aeronautical Research Council (Gt. Brit.)
EXPERIMENTAL EVIDENCE ON THE DRAG AT ZERO LIFT ON A SERIES OF SLENDER DELTA WINGS AT SUPERSONIC SPEEDS, AND THE DRAG PENALTY DUE TO DISTRIBUTED ROUGHNESS
M. C. P. Firmin London, HMSO, 1964 56 p refs Supersedes RAE-TN-AERO-2871, ARC-24843
(ARC-CP-737; RAE-TN-AERO-2871, ARC-24843) HMSO: 18s 6d

Measurements were made of the drag at zero lift on a series of low-drag delta wings of diamond cross section, with and without distributed roughness. After allowance was made for the skin friction, wave drag factors obtained were compared with theoretical estimates. Thin-wing theory gives reasonably reliable estimates for the wave drag factor (K_o), but tends to overestimate the change in drag as the trailing-edge slope is increased. Slender body theory should not be relied upon to calculate the zero lift wave drag factors, since in the region of the trailing edge the assumption of slenderness $|| \beta^2 \phi_{xx}| << | \phi_{yy} | + | \phi_{zz} ||$ is only valid for a very restricted range of wings. Author

N65-10474# Aeronautical Research Council (Gt. Brit.)
LOW-SPEED WIND-TUNNEL TESTS ON THE CHARACTERISTICS OF LEADING-EDGE AIR INTAKES IN SWEPT WINGS

J. Seddon and D. J. Kettle London, HMSO, 1964 43 p refs Supersedes RAE-AERO-2402; ARC-13899
(ARC-R&M-3353; RAE-AERO-2402; ARC-13899) HMSO: 17s

Low-speed wind-tunnel tests have been made to determine the external and internal characteristics of leading-edge air intakes in swept wings, under flight conditions. Tests on a delta model show that leading-edge intakes in the wing root give an advantage in effective sweepback and critical Mach number (estimated from the low-speed pressure distribution) compared with nacelle-type intakes adjacent to the body. The internal loss in level flight for a 52° sweptback entry is 4% ram worse than when the entry is square to the direction of flight. The explanation of this loss is found in the nature of the preentry retardation for level-flight velocity ratios. A boundary-layer bypass leading from a slot inside the intake removes most of the additional loss. Tests on a swept-wing model with a simplified intake give the effects of duct diffusion, of boundary layer from an adjacent body, and of boundary-layer removal through a slot or porous wall. A general formula for intake loss is applied to show the dependence of the loss on entry shape and on the value of the design velocity ratio. Author

N65-10557 Aeronautical Research Council (Gt. Brit.)
PRESSURE-PLOTTING AND FORCE TESTS AT MACH NUMBERS UP TO 2.8 ON AN UNCAMBERED SLENDER WING OF $p = 1/2$ $s/c_0 = 1/4$ ('HANDLEY PAGE OGEE')
A. L. Courtney and A. O. Ormerod London, HMSO, 1964 61 p refs Supersedes RAE-TN-AERO-2760, ARC-23109
(ARC-R&M-3361; RAE-TN-AERO-2760; ARC-23109) HMSO: £1 5s

At zero lift, the wave-drag factor K_0 is about 0.2 below the slender-theory value at all Mach numbers, due to the absence of a predicted rapid expansion toward the trailing edge. Apart from the difference near the trailing edge, the measured zero-lift pressures are in quite good agreement with slender or linear thin-wing theory. At incidence, the pressure gradients are everywhere favorable behind the leading-edge vortex, and there is a large trailing-edge load that is not predicted by slender theory. The cruising center of pressure is $0.075c_0$ behind the low-speed aerodynamic center at $C_l = 0.5$. At $M = 2.2$, K_0 is 0.72 and the lift-dependent drag factor is 1.92, giving an estimated full-scale maximum L/D of 8.3 excluding engines. Author

N65-10558 Aeronautical Research Council (Gt. Brit.)
PRESSURE DISTRIBUTIONS AND FLOW PATTERNS AT M = 4.0 ON SOME DELTA WINGS. PART I: WINGS OF INVERTED 'V' CROSS-SECTION. PART II: 'FLAT' WINGS
L. C. Squire London, 1964 33 p refs Supersedes RAE-TN-AERO-2838; RAE-TN-AERO-2865, ARC-24449, ARC-24831
(ARC-R&M-3373; RAE-TN-AERO-2838; RAE-TN-AERO-2865; ARC-24449; ARC-24931) HMSO: 13s 6d

Wind-tunnel tests have been made to measure pressure distributions and to study flow patterns on a series of delta wings of inverted-V cross section. Each of these wings was designed to have a plane shock wave in the plane of the leading edges at a chosen Mach number and incidence. It was found that for a wide incidence range about the design point the shock wave remained virtually attached to the leading edges and at each incidence the pressure was approximately constant over the lower surface. Author

N65-10559 Aeronautical Research Council (Gt. Brit.)
WIND TUNNEL TESTS AT SUPERSONIC SPEEDS ON A MODEL OF THE FAIREY DELTA 2
M. D. Dobson London, HMSO, 1964 75 p refs Supersedes RAE-TN-AERO-2844, ARC-24606
(ARC-CP-672; RAE-TN-AERO-2844; ARC-24606) HMSO: 13s 6d

Results are given of tests at Mach numbers from 1.42 to 2.00, on a 1/24-scale model of the Fairey Delta 2 aircraft. Lift, pitching moment, axial force, sideforce, yawing moment, and rolling moment were measured, giving an assessment of the general stability characteristics, including the effects of airbrakes and a ventral fuel tank. Elevator effectiveness and aileron effectiveness were measured. Incremental values of drag were obtained resulting from separate addition of airbrakes and fuel tank, and the application of elevator and aileron. No absolute values of drag are presented owing to difficulties in measuring the internal drag of the intake system. Author

N65-10560 Aeronautical Research Council (Gt. Brit.)
WIND TUNNEL MEASUREMENTS OF NORMAL FORCE AND PITCHING MOMENT AT A MACH NUMBER OF 2.00 ON A 1:30 SCALE MODEL OF BLUE STREAK
E. Huntley London, HMSO, 1964 37 p refs Supersedes RAE-TN-AERO-2624, ARC-21590
(ARC-CP-732; RAE-TN-AERO-2624, ARC-21590) HMSO: 7s

Tests have been made in a 3- × 3-ft tunnel to determine the stability of a model of the Blue Streak missile both in pitch and in yaw, at a Mach number of 2.00. The effects on the normal force and pitching moment characteristics of changes in the various components of the model were also determined; these included the effects of nose shape, longitudinal splines on the nose, motor fairings, fuel pipes, and fins. The effect of the step in the body profile was also determined both at transonic speeds and at M = 2.00. The model without fins was found to be statically unstable both in pitch and in yaw. With four stabilizing fins attached to the rear of the model it was also unstable, but the moments were reduced by approximately 50% at any given incidence. Author

N65-10588*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FORCE-COEFFICIENT AND MOMENT-COEFFICIENT CORRELATIONS AND AIR-HELIUM SIMULATION FOR SPHERICALLY BLUNTED CONES
Julius E. Harris Washington, NASA, Nov. 1964 50 p refs (NASA-TN-D-2184) OTS Prices: HC $1.25/MF $0.50

An experimental force and moment investigation has been conducted in air, nitrogen, and helium on a family of 10° semi-apex angle cones with various bluntness ratios. The tests were made in three hypersonic facilities. The investigation covered a range of Mach numbers from 9.75 to 19.15, and Reynolds numbers from 0.75×10^5 to 6.12×10^5 for angles-of-attack from 0° to 45°. Analysis of the data from the present investigation, together with data from previous investigations for other cone angles, indicates that a correlation of normal-force and pitching-moment coefficients be made as a function of body geometry and angle-of-attack for slender cones having small to moderate bluntness ratios. The data obtained in air and nitrogen were nearly duplicated in helium for the test conditions of Mach number, Reynolds number, and body geometry studied. Newtonian impact theory was found to predict the trends of the aerodynamic characteristics, and in many instances it quite accurately predicted the actual magnitudes of the force and moment coefficients. Author

N65-10602# Naval Ordnance Lab., White Oak, Md.
WIND TUNNEL INVESTIGATION OF THE MK 76 PRACTICE BOMB

Frank J. Regan Nov. 1964 59 p refs *Its* Aerodyn. Res. Rept.-79
(NAVORD-6772)

The MK 76 is a 25-pound, 4-inch-diameter practice bomb. This report gives the results of the static and dynamic wind-tunnel tests of the basic body with various combinations of fuzes, lugs, and tails. It was decided to replace the original shrouded cruciform tail with two tails of unshrouded design. The first of these was a cruciform tail with a swept leading edge. The basic body was tested with this tail in three positions. The result was a center-of-pressure location 4.0 calibers aft of the nose for the forward position of the tail, to 4.5 calibers aft of the nose for the aft position of the tail. Finally, a cruciform tail of rectangular fins was tested. The result was a center-of-pressure location of about 4.6 calibers aft of the nose. Pitch-damping tests were carried out on the bomb with both the cruciform swept and cruciform rectangular tails. Drag measurements were made of the bomb with both the shroud and cruciform rectangular tails, with combinations of lugs and fuzes. Author

N65-10814# National Physical Lab., Teddington (Gt. Brit.) Aerodynamics Div.
ON THE PERFORMANCE OF LANCHESTER'S "AERIAL TOURBILLION"
G. V. Parkinson Aug. 1963 17 p refs
(NPL-AERO-1069)

Wind-tunnel measurements of the autorotation characteristics of the "aerial tourbillion" are presented in the form of tip speed vs wind speed. Three configurations were tested—a 10.94-in.-diam model with and without a cowling, and a 7.50-in.-diam model without a cowling. All showed a minimum wind speed for autorotation, dependent on friction at the shaft. At each wind speed above this value, there were two equilibrium rotational speeds—an unstable one, giving the required initial rpm for autorotation, and a higher stable one (the autorotation speed) that, with increasing wind speed, rapidly approached proportionality to the wind speed. Fairly good agreement with an approximate blade element theory was demonstrated, the best agreement being obtained with the measurements on the model with cowling. Author

N65-10872# Lockheed Missiles and Space Co., Sunnyvale, Calif. Physical Sciences Lab.
A STUDY OF THE LAMINAR NEAR-WAKE BEHIND A CYLINDER AT MACH 20
C. E. Smith, R. L. Kramer, and A. C. Brown Sep. 1964 27 p refs
(B-07-64-2)

Aerodynamic measurements were made in the wake of a 1-in.-diam, circular-cylinder model in the hotshot wind tunnel. Data were taken at free-stream Reynolds numbers of 1800, 12 000, and 90 000, at Mach numbers near 20. Nitrogen was used as the test gas at stagnation temperatures below 4000° K to minimize real-gas effects. Stagnation-to-model-temperature ratios varied between 5 and 11. Schlieren photographs were obtained, and profiles of pitot pressure were measured from the axis to the bow shock wave at various axial stations. The inviscid flow field, including the embedded wake shock wave, was calculated with the method of characteristics. Profiles of flow variables in the viscous wake were computed. Author

N65-10878# Weapons Research Establishment (Australia)
AN EXPERIMENTAL INVESTIGATION OF INTERFERENCE BETWEEN WINGS AND BODY ON THREE PLANAR AND CRUCIFORM WING AND BODY COMBINATIONS AT MACH NUMBERS OF 2.00 and 2.58
E. R. A. Landers Apr. 1964 99 p refs
(HSA-17)

Pressure distributions were measured on three wing–body combinations at Mach 2.00 and 2.58, and compared with theoretical results and their extension to cruciform configurations. Nonlinear effects due to incidence and sideslip were appreciable. However, a semiempirical nonlinear correction is shown to account largely for the nonlinearities; with this correction, agreement between theory and experiment is generally excellent. Shock-wave–boundary-layer interactions cause significant flow separations for some test conditions; local pressure distributions cannot be reconciled with present theory. Author

N65-10909# National Research Council of Canada, Ottawa Associate Committee on Aerodynamics
EXTRACTS FROM THE FIRST AND SECOND RECOMMENDATIONS OF THE ACOA TO THE TECHNICAL ADVISORY PANEL OF THE NATIONAL AERONAUTICAL RESEARCH COMMITTEE
May 1964 46 p refs
(AD-447541)

The following study proposals are represented: "The Effects of Ground Proximity, Ground Roughness, and Low Level Turbulence on the Aerodynamic Characteristics of VTOL-STOL Aircraft and GEMS"; "The Flying Qualities Required in VTOL–STOL Aircraft and GEMS"; "The Problems of Unsteady Aerodynamics Associated with Separated Flow Including the Determination of Flutter Derivatives"; "Fundamental Aerodynamics of Internal Flow Particularly as Related to Duct Losses and Peripheral Jets"; "The Aerodynamics of Jets and Jet Sheets, the COANDA Effect and the Augmentation of Jet Thrust"; "Theoretical and Experimental Information on the Aerodynamic Characteristics of Propellers at All Angles of Attack"; "The Interaction Between the Propulsive Airstream and the Wing"; "Boundary Layer Control to Suppress Separation Using Both Geometric and Aerodynamic Means"; and "High Speed Aerodynamics." G.G.

N65-10918# Pennsylvania State U., University Park Ordnance Research Lab.
TIP CLEARANCE FLOW IN TURBOMACHINES
W. S. Gearhart 27 Aug. 1964 116 p refs
(Contract NOw-63-0209-c)
(TM-506.2491-014; AD-451200)

To prevent physical contact between a rotating member, such as a rotor blade, and a guide wall requires that some finite clearance be maintained between the blade end and the wall. This clearance at the blade tip coupled with the associated pressure difference across the blade encourages a flow over the blade end from pressure face to suction face, which has been designated as the tip clearance flow. Two forms of cavitation have been recorded and attributed to the tip clearance flow. Cavitation resulting from this flow in the clearance area between the blade end and guide wall has been termed "gap cavitation." A second form of cavitation originates from the interaction of the tip-leakage flow and main flow in the blade passage. This form of cavitation is termed the "tip vortex cavitation." Author

N65-10937# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SOME ACCURATE SOLUTIONS OF THE PROBLEM OF NATURAL VIBRATIONS OF A SWEPT-BACK WING IN A SUPERSONIC FLOW OF GAS
V. M. Lyubimov 27 Dec. 1963 12 p refs Transl. into ENGLISH from Inzh. Zh. (Moscow), v. 31 1961 p 171–178
(FTD-MT-63-144; AD-602563)

The wing investigated was characterized by a cantilever beam of varying elasticity during flexure and torsion. Particular cases of pure torsional, combined flexural–torsional, and pure flexural flutter were considered. The assumption was made that the wing's flexural axis coincided with the line of centers of masses and that the chord was constant. It is concluded that during purely torsional and combined flexural and torsional disturbed motions of the wing, flutter and divergence cannot occur with the same frequency. During purely flexural motions it is possible for flutter and divergence to occur. P.V.E.

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N65-10209# General Dynamics/Convair, San Diego, Calif.
ENGINEERING SUMMARY OF AIRFRAME ICING TECHNICAL DATA
D. T. Bowden, A. E. Gensemer, and C. A. Skeen Washington, D.C., FAA, Mar. 1964 482 p refs
(Contract FA-WA-4250)
(FAA-ADS-4)

This report provides an engineering summary of selected technical data on airframe icing conditions, methods of detecting, preventing, and removing ice from airframes in flight, and methods of testing ice protection systems to insure their adequacy. An aircraft engineer can use this report to design adequate ice-protection systems for any type aircraft for any flight mission profile. Author

N65-10295# Aviation Safety Engineering and Research, Phoenix, Ariz.
PERSONNEL RESTRAINT SYSTEMS STUDY, CH-47 VERTOL CHINOOK Crash Injury Evaluation
Joseph L. Haley, Jr. and James P. Avery Ft. Eustis, Va., Army Transportation Res. Command, Apr. 1964 67 p refs
(Contract DA-44-177-AMC-888(T))
(TRECOM-TR-64-4; AD-607658)

This report presents detailed recommendations for the strengthening of existing components. The modifications proposed indicate the following strength improvements: (1) Cockpit—The crew's restraint system is increased from an 8 to 12 g value to a 25 to 30 g value. (2) Troop Compartment—The troop's lap-belt attachments are increased from a 10 to 15 g value to a 22 to 28 g value. The above strength increases can be achieved with a weight increase of 7 pounds per aircraft and at a cost of approximately $300 per aircraft. Author

N65-10367 Aeronautical Research Council (Gt. Brit.)
STATIC TESTS OF GROUND EFFECT ON PLANFORMS FITTED WITH A CENTRALLY-LOCATED ROUND LIFTING JET
L. A. Wyatt London, Min. of Aviation, 1964 29 p refs Supersedes RAE-TN-AERO-2826, ARC-24099
(ARC-CP-749; RAE-TN-AERO-2826, ARC-24099) HMSO: 6s

Static measurements of the thrust losses due to ground effect on a range of plane circular, rectangular, and delta wings of various aspect ratios with a single round lifting jet located centrally on the planform are described. A satisfactory correlation of the results is presented. Author

N65-10390# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STABILITY OF MOTION OF AN AIRCRAFT, CONTROLLED BY AN AUTOPILOT OVER THE TAKE-OFF–LANDING STRIP
L. G. Lobas 23 Sep. 1964 14 p refs Transl. into ENGLISH from Pryk. Mekh. (Kiev), v. 9, no. 6, 1963 p 659–669
(FTD-TT-64-566/1+2; AD-607124)

The stability of an automatically controlled movement over a takeoff and landing strip by an aircraft with a tricycle or a bicycle landing gear was investigated. It was assumed that the aircraft is a system of absolute solid bodies, and that the supporting surface of the wheels is a nondeformed surface of a torus, with the contact of the wheels on the runway surface realized in one point. The inertial Descartes system of coordinates was used in evolving the equations. G.G.

N65-10475 Aeronautical Research Council (Gt. Brit.)
INFLATED MOBILE LIFTING STRUCTURES: ANALYSIS OF GENERATOR-CORD CONSTRUCTION FOR CIRCULAR PLANFORMS
W. G. S. Lester London, HMSO, 1964 46 p refs Supersedes RAE-TN-MECH-ENG-356; ARC-24501
(ARC-R&M-3377; RAE-TN-MECH-ENG-356; ARC-24501) HMSO: 18s 6d

A model of a system is considered in which the load is carried in a set of cords attached to the periphery of an annular base. These cords are shorter than the length of fabric gore that lies between them and bows outward under the excess pressure. The statics of the structure are analyzed, and for practical design purposes the base orifice area should be less than half the projected area of the canopy below the load suspension points. Possible equilibrium configurations are investigated, and a method for calculating the fabric gore shape is given. Formulas for designing an actual system are included. Author

N65-10507# Aviation Safety Engineering and Research, Phoenix, Ariz.
PERSONNEL RESTRAINT SYSTEM STUDY, CH-47 VERTOL CHINOOK. CRASH INJURY EVALUATION, SUPPLEMENT
Ft. Eustis, Va., Army Transportation Res. Command, Apr. 1964 37 p
(Contract DA-44-177-AMC-888(T))
(TRECOM-TR-64-4, Suppl.; AvCIR-62-26; Suppl., AD-607659)

Components of the individual restraint system for the passengers of the CH-47 helicopter are described, and their installation is outlined. P.V.E.

N65-10638*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FLIGHT MEASUREMENTS OF STABILITY AND CONTROL DERIVATIVES OF THE X-15 RESEARCH AIRPLANE TO A MACH NUMBER OF 6.02 AND AN ANGLE OF ATTACK OF 25°
Roxanah B. Yancey Washington, NASA, Nov. 1964 49 p refs
(NASA-TN-D-2532) OTS Prices: HC $1.25/MF $0.50

Flight tests of the X-15 airplane provided data from which longitudinal, lateral, and directional stability and control derivatives were determined over a Mach number range from 0.60 to 6.02 and over an angle-of-attack range from −2.7° to 25°. The data were obtained with the lower rudder on and off, speed brakes open and closed, and power on and off. The longitudinal derivatives show the expected trends of increasing levels through the transonic region and of diminishing levels as the Mach number increases in the supersonic region. A high level of longitudinal stability is indicated by the flight data. Author

N65-10822*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LATERAL CONTROL CHARACTERISTICS OF A POWERED MODEL OF A TWIN-PROPELLER DEFLECTED SLIPSTREAM STOL AIRPLANE CONFIGURATION
Richard J. Margason and Alexander D. Hammond Washington, NASA, Nov. 1964 203 p refs
(NASA-TN-D-1585) OTS Prices: HC $3.50/MF $1.25

Results are presented of a wind-tunnel investigation on the static lateral and directional control capabilities of a two-propeller deflected-slipstream STOL airplane in the takeoff and landing speed ranges. The results show that neither the ailerons nor differential propeller thrust alone provide adequate lateral-directional control, but they indicate that the lateral-directional control characteristics of the aileron were good when used in conjunction with differential propeller thrust. The results also indicate that rolling moments large enough for lateral control, even with the single engine-out condition, can be obtained from a full-span slot lip aileron (spoiler), but that some adverse yawing moment is produced. Author

N65-10902# Toronto U. (Canada) Inst. for Aerospace Studies
ANNUAL PROGRESS REPORT—1964
Oct. 1964 233 p refs

Progress is summarized in the following areas of investigation: (1) "Mechanics of Rarefied Gases"; (2) "Plasma Dynamics"; (3) "Hypersonic Gasdynamics and Blast Wave Phenomena"; (4) "Aerodynamic Noise"; (5) "Subsonic Aerodynamics"; (6) "Aerospace Flight Dynamics"; (7) "Materials Science and Structures"; (8) "Upper Atmospheric Research"; (9) "Molecular Beams and Surface Interactions"; (10) "Magnetogasdynamic Power Generation"; and (11) "Industrial and Architectural Aerodynamics." P.V.E.

N65-10903# Sperry Gyroscope Co., Great Neck, N.Y.
ALL-WEATHER LANDING DISPLAY FOR DC-7 Final Report
Jun. 1964 203 p
(Contract FA-WA-4449)
(HB-9202-0074; RD-64-71)

An all-weather landing display was installed in a DC-7 aircraft. The display is intended to enable the pilot to monitor automatic landings and to provide manual landing capability under low-visibility conditions. The display system and its components are described, as well as modifications to the DC-7, operational procedures, system bench-test results, and ground and flight test plans. It is concluded that this system represents a valuable tool for assessing the role of the pilot in all-weather display investigations, and continuation of the flight-test program is recommended until an operationally satisfactory and economically feasible all-weather display system is achieved. M.P.G.

N65-10904# Princeton U., N.J.
THE LONGITUDINAL EQUATIONS OF MOTION OF AN AIRBORNE TOWED VEHICLE INCORPORATING AN APPROXIMATION OF CABLE DRAG AND INERTIA EFFECTS
E. H. Law May 1964 70 p refs
(Contract N62269-1369)
(Rept.-687; AD-602734)

This report describes improvements in the development and application of the linearized equations of the motion of airborne towed vehicles. Both the aerodynamic and the inertial perturbation forces are considered as restraining effects of the cable upon the towed vehicle, and an approximation method that utilizes these two effects is proposed in order to avoid the formulation of the complete cable equations. Also included are approximations of the perturbation drag forces on a cable and the inertial force on the cable in a particular case where all cable oscillations are absent. G.G.

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N65-10047*# Gulton Industries Inc., Metuchen, N.J. Alkaline Battery Div.
INVESTIGATION OF BATTERY ACTIVE NICKEL OXIDES First Quarterly Report, 11 Jun.–11 Sep. 1964
P. Ritterman [1964] 75 p refs
(Contract NAS3-4178)
(NASA-CR-54196) OTS Prices: HC $3.00/MF $0.75

A literature review of recent articles dealing with the chemical structure and composition of the nickel oxide electrode is presented. The entire program for this project is outlined, and the work completed to date is discussed. Sintered-plate nickel oxide electrodes completed all formation cycling. Initial data for a self-discharge stand is given for 10°, 25°, and 50°C. Also, X-ray diffraction patterns of the charged nickel oxide electrodes are given. Author

N65-10219# Army Missile Command, Huntsville, Ala. Army Inertial Guidance and Control Lab.
EXPLODING BRIDGEWIRE ELECTRICAL SYSTEM TEST UNIT, JANUARY 1963–MARCH 1964
James Darryl Holder 11 Sep. 1964 24 p
(RG-TR-64-13; AD-449348)

Two basic designs were conceived and tested. The first design using a two-element spark gap and a calibrated fuse link did not prove successful. The second method using a passive network and a three-element spark gap was shown to be capable of yielding an adequate test for EBW Systems. Author

N65-10290# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ELECTRONICS' NEW RIVAL
I. Makarov and A. Dubov 25 Sep. 1964 8 p Transl. into ENGLISH from Izv. (Moscow), 4 Feb. 1964 p 5
(FTD-TT-64-762/1; AD-607312)

This is a description of a new universal system of industrial pneumoautomatics consisting of a set of unified elements of a select and continuous action, each of which implements some simple operation. They are grouped in pneumorelays, summation devices, "memory" elements, pneumoresistors, pneumocapacitators, etc. Each of these elements outwardly resembles radionic tubes; however, each contains one or more membranes. The combination of these elements with each other is accomplished by a method of printed montage analogous to that adopted in radio technology, with the pneumatic combinations utilizing the channels in the montage plate. G.G.

N65-10314*# Douglas Aircraft Co., Inc., Newport Beach, Calif. Astropower Lab.
INORGANIC ION EXCHANGE MEMBRANE FUEL CELL Quarterly Report, Period Ending 10 Oct. 1964
C. Berger et al Oct. 1964 30 p ref
(Contract NAS3-6000)
(NASA-CR-54199; SM-46221-Q1) OTS Prices: HC $2.00/MF $0.50

Improved zirconium dioxide–phosphoric acid–"Zelon H" fuel-cell membranes, having a transverse strength as high as 5000 to 7500 psi, have been developed for inorganic ion-exchange fuel-cell membranes. Their markedly improved fuel-cell performance was observed during tests. The electrolyte–catalyst combinations were studied with two additional laboratory-scale fuel cells. The relationship between the sintering temperature and the resistivity was obtained, and it was found that the hydrolytic stability of the membrane increases with the increasing final sintering temperature. G.G.

N65-10360# Army Dept., Washington, D.C. Office of the Assistant Chief of Staff for Intelligence
OPTICS IN INSTALLATION FOR THE UTILIZATION OF SOLAR ENERGY
V. B. Veynberg [1959] 193 p refs Transl. into ENGLISH of the book "Optika v Ustanovkakh Dlya Ispol'zovaniya Solnechnoy Energii" Moscow, Oboronitz, 1959 p 1–185
(H-4787; AD-422126)

The development of solar energy technology (heliotechnics) and discussions of possible techniques and conditions for applying solar energy in the national economy are presented. Data are provided on solar radiations in the area of the U.S.S.R. Methods are presented for determining the most advantageous parameters of devices used for sunray concentration and for systems of transparent heat insulation. Methods of computing output of solar units are proposed. Discussed are instruments that simulate natural conditions of illumination in the investigation of models of structures. Recommendations are given for selecting orientation and inclination of receivers, planning of buildings, and types of transparent insulation and windows. Author

N65-10362# Boeing Co., Seattle, Wash.
BASIC RELATIONSHIPS FOR THE PRELIMINARY DEFINITION OF AN ON–OFF ATTITUDE CONTROL SYSTEM
W. A. Roe [1963] 38 p refs
(D2-21126; AD-445082)

Since an attitude control system is heavily dependent on mission requirements and vehicle payload, emphasis is placed on presenting equations necessary to define a system rather than on showing design curves or on trade studies. The means for determining thrust levels and total impulse required to perform a specified mission are presented. The most important sources of disturbance torques are defined, and the method of determining their magnitude is shown. A method of performance analysis of an on–off gas system for providing control torques is shown. Author

N65-10370*# Electro-Optical Systems, Inc., Pasadena, Calif.
INVESTIGATION OF THERMIONIC ENERGY CONVERSION Final Report, 9 Jul.–9 Sep. 1962
A. O. Jensen and H. R. Moore 10 Sep. 1962 353 p refs
(Contracts NAS7-100; JPL-950188)
(NASA-CR-52917; EOS-2210-Final) OTS Prices: HC $7.00/MF $2.00

The current state of knowledge concerning refractory ceramic oxides useful in thermionic diodes is summarized. Topics considered include high-temperature ceramic materials; emission and thermophysical properties of emitter materials, processing of emitter materials and fabrication of converter materials, ceramic–metal seals, heat transfer in a thermionic converter, spacing techniques, converter physics, and properties of cesium. M.P.G.

N65-10385# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PNEULOG—NEW SYSTEM OF PNEUMATIC CONTROL
Milan Balda 16 Sep. 1964 10 p refs Transl. into ENGLISH from Automatizace (Czechoslovakia), v. 5, no. 3, 1962 p 58–60
(FTD-TT-64-507/1+2; AD-607156)

A description is given of a new pneumatic logical control system. The pneumatic elements contain membranes and are controlled by air pressure. It was found that pneumatic flow elements can be equipped with any arbitrary number of input elements (in contrast to transistors). Fluctuations of the feeding of air pressure in broad limits did not affect the activity of more complex circuits as long as the circuit was fed from the same source. G.G.

N65-10413# Rocketdyne, Canoga Park, Calif.
HIGH-ENERGY BATTERY SYSTEM STUDY Fourth Quarterly Progress Report, 1 Apr.–30 Jun. 1964
J. Farrar, R. Keller, and C. J. Mazac [1964] 27 p refs *Its* Rept.-4
(Contract DA-36-039-AMC-03201(E))
(R-5405-4; AD-450559)

This report period was concerned with half-cell studies to clarify certain points with regard to electrode performance. Lithium anodes were found to be stable over a period of about 1 week, and they showed a high utilization efficiency. Cathodes based upon AgO and MnO_2 polarized strongly in propylene carbonate, but performed better in acetonitrile. Sulfur was a beneficial additive to carbon in AgO electrodes. Silver halides electrodeposited on sintered silver gave good performance in both propylene carbonate and acetonitrile. Ethylpyridinium bromide and succinonitrile were tested as candidate electrolyte solvents, but the specific conductivities of the solutions were

not higher than those found earlier with other organic solvents. The interpretation of current interruption curves is discussed. Author

N65-10468# Magna Corp., Anaheim, Calif. Research and Development Div.
BIOCHEMICAL FUEL CELLS Eighth Quarterly Progress Report, 1 Apr.–30 Jun. 1964
J. J. Cavallo [1964] 31 p refs
(Contract DA-36-039-SC-90866)
(Rept.-8; AD-450037)

A biochemical fuel cell battery combining a formic acid bioanode with an air cathode was fabricated and successfully demonstrated. Current-potential data obtained with this battery, utilizing lyophilized cells of *Aeromonas formicans* and coconut milk are presented. Investigation of the formic acid bioanode using *Aeromanos formicans* as the biological catalyst was continued. Great emphasis was placed on the preparation and analysis of natural carbohydrates for use as substrates in bioelectrode studies. Current-potential data obtained with the substrates coconut milk and banana extract are reported. The effects of varying the initial pH and ionic strength of a phosphate buffer system on the growth and concomitant acid production by *Aeromonas formicans* are also reported. Author

N65-10489# General Motors Corp., Indianapolis, Ind. Allison Div.
HIGH VOLTAGE THERMIONIC CONVERTERS Technical Documentary Report, 1 Mar.–31 Aug. 1964
D. L. Dresser Wright-Patterson AFB, Ohio, AF Aero Propulsion Lab., Oct. 1964 95 p refs
(Contracts AF 33(615)-1533; AF 33(657)-9106; AF 33(657)-7026)
(EDR-3999; APL-TDR-64-120; AD-607864)

This report explains theoretically and demonstrates experimentally the high-output-voltage performance obtained from newly developed converters. Several emitter materials and two emitter geometries were evaluated in a flexible laboratory thermionic-converter design. It was concluded that converters with improved planar rhenium emitters will be feasible. A slotted rhenium emitter at 1800° K promises to meet the high-voltage requirements. G.G.

N65-10516# General Electric Co., Pleasanton, Calif. Special Purpose Nuclear Systems Operation
INVESTIGATION OF THERMIONIC CONVERTER OPERATING WITH A HIGH TEMPERATURE COLLECTOR Second Quarterly Technical Report, 15 May–15 Aug. 1964
Wright-Patterson AFB, Ohio, AF Aero Propulsion Lab. [1964] 47 p ref
(Contract AF 33(615)-1545)
(GEST-2037; AD-605539)

This progress report on experimental investigations of thermionic converters with high-temperature collectors contains the following subjects: "Vacuum Measurements"—the vacuum work-function measurement, and the emitter heat-loss calibration; "Cesium Measurements"—the determination of light absorption by cesium vapor, the effect of cesium pressure on the power output, the current-voltage characteristics for different spacings, the effect of the collector temperature on the current-voltage characteristics, and the light attenuation by a sapphire window; "Post-Test Examination of Converter"; and "Fabrication of the Cooled Collector Converter Components"—the emitter electrode, the NaK cooled collector electrode, and a braze-evaluation program. G.G.

N65-10583# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering
ION CLOUD SHAPE AND POTENTIAL DISTRIBUTION IN AN ELECTRO-FLUID-DYNAMIC GENERATOR
James Robert Wifall (M.S. Thesis) Jun. 1964 84 p refs
(GAM/ME/64-22; AD-604827)

The purpose of this study was to experimentally determine the ion cloud shape and potential distribution within the conversion section of an electro-fluid-dynamic (EFD) generator. The EFD generator consisted of a closed, pressurized loop with an ejector powering the secondary airflow. Negative ions, formed by a corona discharge from a needle centered within the ejector nozzle, were carried downstream through the conversion section by high pressure air and were neutralized by the collector. A uniform electrostatic field with, and without a corona discharge, was investigated. Author

N65-10635*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
PERFORMANCE OF SOLAR REFLECTORS WHEN APPLIED TO STORAGE OF CRYOGENIC PROPELLANTS IN SPACE
Curt H. Liebert and Robert R. Hibbard Washington, NASA, Nov. 1964 13 p refs
(NASA-TN-D-2509) OTS Prices: HC $0.50/MF $0.50

An analysis was performed to determine the effectiveness of solar reflectors in reducing heat transfer through the insulation of cryogenic fuel tanks located in deep space. A solar reflector is defined as a surface having a ratio of absorptance with respect to solar radiation to hemispherical emittance (α/ϵ) less than 1.0. This analysis considers the effect of surface coatings with α/ϵ values varying from 0.1 to 1.0 when applied to the external surfaces of bulk insulation or multifoil insulation. Results were obtained in terms of heat leak to two cryogenic propellants—liquid hydrogen and liquid oxygen—when stored at Mars, Earth, and Mercury orbital distances from the sun. Author

N65-10688*# Allis-Chalmers Mfg. Co., Milwaukee, Wis. Research Div.
RESEARCH AND DEVELOPMENT ON FUEL CELL SYSTEMS First Quarterly Progress Report, 1 Aug.–30 Sep. 1964
P. D. Hess, J. R. Hurley, G. Johnson, R. E. Lochen, and C. Martin 30 Oct. 1964 17 p
(Contract NAS8-2696)
(NASA-CR-59455) OTS Prices: HC $1.00/MF $0.50

An all-out effort was directed toward the fabrication and verification test of a 2000-watt, 28 ±2 volt breadboard system, and the fabrication and acceptance testing of the 1800-watt, 29 ±2 volt, fuel-cell breadboard system. An existing 1.5-kW fuel-cell breadboard system was dismantled and inspected, and design specifications were reviewed. A number of design modifications were made to permit an increase in the rating of the design to 28 volts at 2000 watts. Refurbishing of the breadboard system was completed. Significant effort was applied to the preparation of the technical plan and quality-assurance plan. Author

N65-10840*# Eagle-Picher Co., Joplin, Mo. Couples Dept.
INVESTIGATIONS LEADING TO THE DEVELOPMENT OF A PRIMARY ZINC-SILVER OXIDE BATTERY OF IMPROVED PERFORMANCE CHARACTERISTICS Progress Report No. 11, 1 May–31 May 1964
B. R. Hawkins [1964] 25 p
(Contract NAS8-5493)
(NASA-CR-59500) OTS Prices: HC $1.00/MF $0.50

A statistical approach to improving the performance of primary zinc–silver oxide batteries has resulted in a cell of improved design. An attempt was made to determine an equation describing voltage and capacity response for cells of varying design characteristics. Experimental data from 16 responses were used in the equation that, if the test variables were constant and included no important interactions, would predict responses for any of 5000 possible cell designs. However, due to interactions of several of the cell variables, the effect of including a specific design factor could not be reliably predicted. The data also indicate that measures to improve capacity retention are deleterious to voltage control and vice versa. The design features of the test cells that were above average in both respects have been incorporated in the improved battery, including the use of a silver positive grid. Individual cells may be expected to perform reliably after 4 days activated stand at 130° F and 2 weeks at 70° F. M.P.G.

N65-10954*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
STUDY OF WETTING AND NONWETTING MERCURY CONDENSING PRESSURE DROPS
Alfred Koestel (TRW, Inc.), Martin U. Gustein, and Robert T Wainwright Washington, NASA, Nov. 1964 55 p refs
(NASA-TN-D-2514) OTS Prices: HC $1.00/MF $0.50

Local static pressures were measured along tubes in which mercury vapor was flowing and condensing. The test sections consisted of constant-diameter tubes having inside diameters of 0.319 and 0.397 in. and a tapered tube of 0.4 to 0.2 in. i.d. The condensing lengths varied between 4 and 8 ft. The range of the mercury flow rates was 1.05 to 3 lb/min at inlet pressure of 8 to 30 psia. The local two-phase frictional pressure drop data were obtained by assuming the average liquid velocity equal to the average vapor velocity at each location within a test section (i.e., a slip ratio of 1). A comparison of these data with the Lockhart–Martinelli correlation showed significant deviations, particularly at the low qualities. A relation between the local two-phase frictional pressure drop and the Weber number (based on the superficial vapor velocity), derived from fog-flow considerations, correlated the trend of the data over the full quality range. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; protective clothing and equipment; physiological and psychological factors. For related information see also: 05 Biotechnology.

N65-10012# University Coll., Cork (Ireland)
STUDIES OF THE PROPERTIES AND STRUCTURE OF PURIFIED MAMMALIAN ADENOSINE DEAMINASE ISOLATED FROM CALF INTESTINE Third Annual Technical Status Report, 1 Jul. 1963–1 Jul. 1964
Thomas G. Brady [1964] 26 p refs
(Contract DA-91-591-EUC-2901)
(AD-444390)

Various modifications of the purification procedure have been investigated in an effort to eliminate bacterial contamination, reduce inactivation, and give stable concentrates. By means of Sephadex columns it has been found that purified preparations of adenosine deaminase usually contain a quantity of inactive material of approximately twice the molecular weight of the active enzyme. Treatment of the enzyme with 2-mercapto-ethanol converts it into lower molecular enzymically active fragments. Bovine lung and spleen have high deaminase activity. High activity is uniformly distributed in cat lung. Dog bone marrow is low active. The levels of deaminase found in some tissues of rat, rabbit, and cat were compared with previously published data. Considerable agreement has been found. The pH optima and isoelectric points of the deaminases isolated from different species have been compared. Further investigations on the separation of the isozymes of calf mucosa are described. By using the zymogram technique, it has been possible to show that mouse duodenum contains three isozymes. Author

N65-10034# Joint Publications Research Service, Washington, D.C.
STUDIES OF INDUSTRIAL TOXICOLOGY
9 Nov. 1964 34 p refs Transl. into ENGLISH from Gigiena Truda i Prof. Zabolevaniya (Moscow), v. 8, no. 9, Sep. 1964 p 3–10, 25–28, 42–45, 62–63
(JPRS-27282; TT-64-51538) OTS: $2.00

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1. VANADIUM SMELTING IN THE LIGHT OF INDUSTRIAL HYGIENE AND PROBLEMS PERTAINING TO THE PREVENTION OF OCCUPATIONAL DISEASES AND POISONING I. V. Roshchin p 1–11 refs
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4. LENINGRAD SYMPOSIUM ON PROBLEMS OF GENERAL INDUSTRIAL TOXICOLOGY Ye. T. Lykhina and N. A. Minkina p 27–31

N65-10037# Joint Publications Research Service, Washington, D.C.
STUDIES IN NEUROPATHOLOGY AND PSYCHIATRY
12 Nov. 1964 47 p refs Transl. into ENGLISH from Zh. Nevropatol. i Psikhiatr. (Moscow), v. 64, no. 5, 1964 p 680–685, 690–693, 723–728, 730–734, 768–770
(JPRS-27337; TT-64-51593) OTS: $2.00

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3. ON CLINICAL DYNAMICS OF NEURASTHENIA V. V. Korolev p 23–32 refs
4. ON THE CLINICAL DYNAMICS OF SO-CALLED ORGANIC PSYCHOPATHIES I. L. Kulev p 33–40 refs
5. ON THE PROBLEMS OF ADMINISTRATION OF INDOPAN IN A PSYCHIATRIC CLINIC V. G. Lavit, T. N. Morozova, and A. N. Popova p 41–44

N65-10039# Joint Publications Research Service, Washington, D.C.
CHEMICAL PROPHYLAXIS OF RADIATION INJURIES
A. S. Mozzhukhin and F. Y. Rachinskiy 4 Nov. 1964 287 p refs Transl. into ENGLISH of the book "Khimicheskaya Profilaktika Radiatsionnykh Porazheniy" Moscow, Atomizdat, 1964 p 1–244
(JPRS-27227; TT-64-51482) OTS: $6.00

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1. CHEMICAL CHANGES CAUSED BY IONIZATION AND EXCITATION OF MOLECULES OF THE IRRADIATED MEDIUM p 4–28 refs

2. CHEMICAL PROTECTION OF CERTAIN ORGANIC SYSTEMS AGAINST ACTION OF IONIZING RADIATION p 29–41 refs

3. PROPERTIES OF RADIOPROTECTIVE COMPOUNDS AND METHODS OF THEIR INITIAL EVALUATION p 42–71 refs

4. MECHANISMS OF BIOLOGICAL ACTION OF IONIZING RADIATION p 72–100 refs

5. CHEMICAL PROTECTION OF BIOLOGICAL MATERIALS AGAINST X-RAYS AND GAMMA RAYS p 101–174 refs

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7. EFFECT OF RADIOPROTECTIVE PREPARATIONS ON FUNCTIONAL STATE OF THE ORGANISM OF HIGHER ANIMALS AND MAN p 212–253 refs

8. POSSIBLE MECHANISMS OF PROTECTIVE ACTION OF AGENTS OF CHEMICAL PROPHYLAXIS OF RADIATION INJURIES p 254–280 refs

N65-10065# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EFFECTIVENESS OF PHARMACOCHEMICAL PROTECTION IN GAMMA IRRADIATION AND IRRADIATION BY PROTONS WITH ENERGIES OF 660 AND 120 Mev
V. S. Shashkov, P. P. Saksonov, V. V. Antipov, V. S. Morozov, G. F. Murin et al *In its* Cosmic Res., Vol. 2, No. 4, 1964 11 Sep. 1964 p 217–231 refs (See N65-10051 01-30)

The effects of gamma rays from Co^{60} and of 660- and 120-MeV protons were compared in experiments on 1360 white mice. At a γ-ray dose rate of 364 R/min, the $DL_{100/30}$ came to 850 R (720 rad). On irradiation in a pulsed beam of 660-MeV protons (dose rate 600 to 700 rad/min), the $DL_{100/30}$ amounted to ~1178 rad. Cystamine (150 mg/kg), aminoethylisothiuronium (150 mg/kg), serotonin (50 mg/kg), and 5-methoxytryptamine (75 mg/kg), injected intra-abdominally 10 to 15 min before γ or proton irradiation, protected 50% to 80% of the animals from death. The protective effects of tryptamine and 5-hydroxytryptophane came to 20% to 25%. The relative biological effectiveness of 660-MeV protons as compared to Co^{60} γ-rays is 0.75 with respect to the DL_{50} for mice, and 0.73 with respect to the DL_{100}. Author

N65-10066# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
OCCURRENCE OF CROSSING OVER IN *DROSOPHILA* MALES UNDER THE INFLUENCE OF VIBRATION, ACCELERATION AND γ-IRRADIATION
G. P. Parfenov *In its* Cosmic Res., Vol. 2, No. 4, 1964 11 Sep. 1964 p 232–241 refs (See N65-10051 01-30)

The influence of vibration, acceleration, and γ-irradiation on the incidence of crossing over in *Drosophila* males is examined. It is customary to assume that this class of hereditary changes is governed by rebuilding of homologous chromosomes in the meiotic stages. This test was also used aboard artificial earth satellites to indicate the biological effect of cosmic radiation, and spotty results were obtained. To analyze the differences that arose, experiments were run with *Drosophila* specimens subjected to acceleration, vibrations, and γ-irradiation, and combinations of these factors. The data obtained are discussed. Author

N65-10112*# Pennsylvania State U., University Park
[CELLULAR BIOPHYSICS: A STUDY OF THE STRUCTURE AND FUNCTION OF LIVING CELLS] Progress Report, Period Ending Jul. 1, 1964
[1964] 46 p refs
(Grant NsG-324)
(NASA-CR-59196) OTS Prices: HC $2.00/MF $0.50

CONTENTS:

1. THE EFFECT OF IONIZING RADIATION ON GENETIC TRANSCRIPTION 14 p refs (See N65-10113 01-04)

2. RATE OF MUTATION TO PHAGE RESISTANCE IN D_2O MEDIUM Ernest Pollard and Martha Lemke 6 p refs (See N65-10114 01-04)

3. THE NATURE OF BACTERIAL REVERTANTS PRODUCED BY THE DECAY OF INCORPORATED TRITIATED COMPOUNDS R. Bockrath and S. Person 22 p refs (See N65-10115 01-04)

N65-10113* # Pennsylvania State U., University Park
THE EFFECT OF IONIZING RADIATION ON GENETIC TRANSCRIPTION
In its [Cellular Biophysics: A Study of the Structure and Function of Living Cells] [1964] 14 p refs (See N65-10112 01-04) OTS Prices: HC $2.00/MF $0.50

Cells of *E. coli* grown on maltose can be induced to produce betagalactosidase by the addition of thiomethyl galactoside (TMG). If cells are irradiated shortly after induction, the transcription of the DNA ceases and the enzyme produced by the messenger RNA is observed to reach a maximum. This enables the calculation of the half-life of unstable messenger RNA. The half-life for this decay is readily measurable, and values are given over a temperature range from 17° C (5.2 min) to 45° C (0.56 min). Author

N65-10114*# Pennsylvania State U., University Park
RATE OF MUTATION TO PHAGE RESISTANCE IN D_2O MEDIUM
Ernest Pollard and Martha Lemke *In its* [Cellular Biophysics: A Study of the Structure and Function of Living Cells] [1964] 6 p refs (See N65-10112 01-04) OTS Prices: HC $2.00/MF $0.50

It has been suggested that a change in a base pair in nucleic acid, between an adenine–thymine pair and a guanine–cytosine pair, constitutes a process of mutation. A further suggestion has been made that this change could be mediated by the tunneling of a proton from one base to another. The process of proton tunneling involves the passage through a potential barrier, and an expression is derived for the probability of such a passage. Cells of *Escherichia coli* were grown in ordinary nutrient broth and in a similar broth made with D_2O. It was concluded from this preliminary experiment that it is not safe to assume that the only basis for the formation of mutants is the process of proton tunneling; in other words, other mechanisms of mutation exist. D.E.W.

N65-10115*# Pennsylvania State U., University Park
THE NATURE OF BACTERIAL REVERTANTS PRODUCED BY THE DECAY OF INCORPORATED TRITIATED COMPOUNDS
R. Bockrath and S. Person *In its* [Cellular Biophysics: A Study of the Structure and Function of Living Cells] [1964] 22 p refs (See N64-10112 01-04) OTS Prices: HC $2.00/MF $0.50

It has been shown that tritiated thymidine decay in bacteria produces mutations as well as lethal events. Uracil, thymidine, histidine, and proline have been investigated as tritium-labeled precursors for RNA, DNA, and protein, and their relative efficiencies for reversion production are given. Since the revertants produced by the decay of different tritium compounds might be different, revertant production was examined in detail as a function of the growth conditions following the accumulation of tritium decays. Results are reported of experimentation for the dependent and independent subclasses in revertant population and for independent revertants as a function of accumulated ^3H decays. Results show two types of revertants produced by ^3H decay. The majority are dependent revertants that give rise to revertant colonies in the presence of nutrient fortification. The relative mutagenic efficiencies are given for the three tritium compounds used. D.E.W.

N65-10119*# Ohio State U., Columbus
THE EFFECTS OF ISOMETRIC WORK ON HEART RATE, BLOOD PRESSURE, AND NET OXYGEN COST
Robert L. Bartels, Richard W. Bowers, Edward L. Fox, Edwin P. Hiatt, and Frank L. Martin [1962] 20 p refs
(Grant NsG-295-62)
(NASA-CR-59419) OTS Prices: HC $1.00/MF $0.50

Six subjects, all athletes or former athletes in good physical condition, exercised in a semireclining, fixed position against a Medart spring dynomometer. Each subject pulled to 60% of his previously determined maximum effect. The heart rate showed a slight increase during exercise followed by a sharp rise in the few seconds following exercise. This was followed by a drop almost to the resting level within 20 to 30 seconds following exercise. Systolic pressure rose following exercise and was highest in the period immediately following exercise. It then dropped slowly to resting levels but had done so in most cases within two and a half minutes. Dystolic pressure fell slightly in the first 30 sec following exercise, and returned to the resting level within a minute and a half. Oxygen consumption varied widely both between subjects and between experiments in the same subject. Author

N65-10120# Joint Publications Research Service, Washington, D.C.
VESTNIK OF THE ACADEMY OF MEDICAL SCIENCES USSR, VOLUME XIX, NO. 7, 1964
22 Oct. 1964 140 p refs Transl. into ENGLISH of Vestn. Akad. Med. Nauk SSSR (Moscow), v. 19, no. 7, 1964 p 3–95 (JPRS-27032; TT-64-51288) OTS: $4.00

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2. THE PROGNOSIS OF DISEASES INVOLVING TEMPORARY INCAPACITATION L. K. Khotsyanov p 8–18

3. SOME URGENT PROBLEMS RELATING TO STANDARD LEVELS OF NEW INDUSTRIAL CHEMICALS IN THE AIR OF WORK PREMISES A. I. Korbakova p 19–27 refs

4. TOXIC FACTORS OF LOW INTENSITY AND THEIR HYGIENIC IMPORTANCE V. A. Pokrovskiy p 28–33 refs

5. CLINICO-MORPHOLOGICAL CHARACTERISTICS OF TOXIC (OCCUPATIONAL) HEPATITIS N. M. Konchalovskaya, T. B. Popova, M. I. Smirnova, and A. S. Mukhin p 33–40 refs

6. PROBLEMS OF OCCUPATIONAL HYGIENE IN OPERATING MECHANIZED TOOLS N. N. Malinskaya, A. P. Filin, and L. N. Shkarinov p 41–50 refs (See N65-10121 01-04)

7. PATHOLOGY OF SILICATOSES P. P. Dvizhkov p 51–60 refs

8. PROBLEMS OF INDUSTRIAL HYGIENE AND OF THE BIOLOGICAL EFFECT PRODUCED BY RADIO-WAVES OF DIFFERENT BANDS Z. V. Gordon p 61–71 refs (See N65-10122 01-04)

9. PROBLEMS OF RADIATION SAFETY IN WORKING WITH RAW MATERIALS OF LOW NATURAL ACTIVITY L. T. Yelovskaya p 72–85 refs (See N65-10123 01-04)

10. SOME POINTS OF PRINCIPLE CONCERNING STANDARDIZATION OF RADIOACTIVE SUBSTANCES Ye. B. Kuriyandskaya p 86–96 refs (See N65-10124 01-04)

11. SOME MEANS TO RAISE THE RADIORESISTANCE OF THE BODY S. P. Yarmonenko p 97–113 refs (See N65-10125 01-04)

12. URGENT PROBLEMS OF RURAL HYGIENE D. P. Belyatskiy and Z. K. Mogilevchik p 113–120

13. CLIMATOPHYSIOLOGICAL IMPORTANCE OF ATMOSPHERIC IONIZATION I. N. Malysheva p 121–128

14. TRACE ELEMENTS IN DRINKING WATER SUPPLY SOURCES OF KAZAKHSTAN IN CONNECTION WITH THE PROBLEM OF CERTAIN NONINFECTIOUS DISEASES I. S. Koryakin, V. G. Alekseyeva, M. S. Govorova, T. V. Voronina, F. A. Daulbayev et al p 129–136 refs

N65-10121# Joint Publications Research Service, Washington, D.C.
PROBLEMS OF OCCUPATIONAL HYGIENE IN OPERATING MECHANIZED TOOLS
N. N. Malinskaya, A. P. Filin, and L. N. Shkarinov *In its* Vestn. of the Acad. of Med. Sci. USSR, Vol. 19, No. 7, 1964 22 Oct. 1964 p 41–50 refs (See N65-10120 01-04) OTS: $4.00

As a result of hygienic and physiological examinations of subjects belonging to different occupational groups in machine building, timber, and mining industries, who are exposed to diverse types of vibrations originating from mechanized tools, data were collected on the effect produced by vibration on the organism and by additional adverse factors. Medical examination of 591 persons revealed the proportional incidence of vibration disease and hearing disorders in each occupational group. From this information, concrete measures to combat the adverse effects of vibration and noise are suggested. Author

N65-10122# Joint Publications Research Service, Washington, D.C.
PROBLEMS OF INDUSTRIAL HYGIENE AND OF THE BIOLOGICAL EFFECT PRODUCED BY RADIO-WAVES OF DIFFERENT BANDS
Z. V. Gordon *In its* Vestn. of the Acad. of Med. Sci. USSR, Vol. 19, No. 7, 1964 22 Oct. 1964 p 61–71 refs (See N65-10120 01-04) OTS: $4.00

Processes involved in the creation and employment of the sources producing electromagnetic waves of the radio-frequency range may be linked with adverse conditions of work. Depending upon the latter, as well as upon technical parameters and the way in which the energy of electromagnetic waves

is actually utilized, various principles of protection against the action of radio waves can be adopted. Biological reactions arising as a result of radio-wave action and, especially, of microwaves are primarily characterized by shifts occurring in the level of the central nervous system (cerebral biopotentials, conditioned reflex activity, response of rats to a sound stimulus, morphological and histochemical changes). Depending upon the waveband, certain peculiarities in the body responses can be noted. Author

N65-10123# Joint Publications Research Service, Washington, D.C.
PROBLEMS OF RADIATION SAFETY IN WORKING WITH RAW MATERIALS OF LOW NATURAL ACTIVITY
L. T. Yelovskaya *In its* Vestn. of the Acad. of Med. Sci. USSR, Vol. 19, No. 7, 1964 22 Oct. 1964 p 72–85 refs (See N65-10120 01-04) OTS: $4.00

Material is presented characterizing the magnitude of the radiation factor in different branches of industry. The extent of the radiation hazards that may attend handling crude stocks and raw materials containing natural radioactive substances in incidental amounts is assessed. Attention is directed to the necessity of elucidating the biological significance of all constituents of the radiation factor, with particular reference to its thorium component. Author

N65-10124# Joint Publications Research Service, Washington, D.C.
SOME POINTS OF PRINCIPLE CONCERNING STANDARDIZATION OF RADIOACTIVE SUBSTANCES
Ye. B. Kurlyandskaya *In its* Vestn. of the Acad. of Med. Sci. USSR, Vol. 19, No. 7, 1964 22 Oct. 1964 p 86–96 refs (See N65-10120 01-04) OTS: $4.00

The main attention is focused on the interaction between the organism and the external environment—the protective and adaptive reflexes and responses of the body to the influence of various environmental factors, including ionizing radiation. The definition of maximum permissible concentrations of chemical and radioactive substances and levels of ionizing radiation effects accepted in Soviet hygienic practice and abroad is given. The thresholds of physiological and pathological reactions arising under the influence of environmental factors are considered. Author

N65-10125# Joint Publications Research Service, Washington, D.C.
SOME MEANS TO RAISE THE RADIORESISTANCE OF THE BODY
S. P. Yarmonenko *In its* Vestn. of the Acad. of Med. Sci. USSR, Vol. 19, No. 7, 1964 22 Oct. 1964 p 97–113 refs (See N65-10120 01-04) OTS: $4.00

Under discussion are the mechanism governing the action of certain means of chemical antiradiation protection, and its relation to postradiation restoration under diverse conditions (acute, fractionate, and chronic) and types (roentgen, gamma rays, and high-energy protons) of radiation effect. The chromosome system of somatic animal cells is demonstrated to be capable of repair following irradiation with a low dose. Attention is directed toward the necessity of investigating factors modifying different manifestations of the radiobiological effect in order to arrive at a scientifically formulated hygienic standardization of ionizing radiations. Author

N65-10212# Joint Publications Research Service, Washington, D.C.
VESTNIK OF USSR ACADEMY OF MEDICAL SCIENCES, VOLUME XIX, NUMBER 6, 1964
2 Nov. 1964 132 p refs Transl. into ENGLISH from Vestn. Akad. Med. Nauk SSSR (Moscow), v. 19, no. 6, 1964 p 3–88 (JPRS-27178; TT-64-51434) OTS: $4.00

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2. PREMATURE FUNCTION OF THE FETUS AS A BIOMEDICAL PROBLEM L. I. Gromov and Ye. A. Savina p 10–22 refs

3. MEDICAL STUDY OF LONG-LIVED PERSONS IN THE USSR D. F. Chebotarev and N. N. Sachuk p 23–30

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5. STRUCTURAL PRINCIPLES IN THE FORMATION OF CONDITIONED REFLEXES TO VISUAL AND AUDITORY STIMULI N. M. Khananashvili p 37–48 refs

6. CLINICAL ASPECTS AND ETIOLOGY OF POLYSEASONAL MENINGOENCEPHALITIDES O. A. Khondkarian, M. D. Skobel'skiy, L. M. Khvan, and A. I. Burak p 49–60 refs

7. MORPHOLOGICAL CHANGES IN THE CENTRAL AND PERIPHERAL NERVOUS SYSTEMS IN EXPERIMENTAL INFLUENZA Yu. S. Martynov p 61–67 refs

8. NEPHROPATHY IN MULTIPLE MYELOMA (PARAPROTEINEMIC NEPHROSIS) N. Ye. Andreyeva and V. V. Serov p 68–80 refs

9. ANALYSIS OF THE NEUROHUMORAL-HORMONAL CHANGES IN SOME VIGILANCE DISORDERS N. I. Grashchenkov, G. N. Kassil', I. L. Vaysfel'd, A. M. Veyn, E. Sh. Matlina et al p 81–93 refs

10. NEUROPSYCHIC DISORDERS IN HYPOXIC STATES IN CONNECTION WITH SURGICAL TREATMENT OF CARDIAC DEFECTS L. O. Badalyan and V. V. Kovalev p 94–104 refs

11. MYASTHENIA-LIKE SYNDROME AND THYMOMAS IN EXPERIMENTS G. Ya. Svet-Moldavskiy, N. M. Spektor, and L. I. Ravkina p 105–109 refs

12. PREVENTION OF TUMORS IN HAMSTERS INFECTED WITH THE SV-40 VIRUS G. I. Deychman and T. Ye. Klyuchareva p 110–115 refs

13. RADIOTELEMETRIC INVESTIGATION OF THE TEMPERATURE IN THE HUMAN STOMACH AND INTESTINE IN NORMAL AND PATHOLOGICAL CONDITIONS B. Ye. Votchal, A. S. Belousov, L. N. Zvyagina, and N. N. Braytseva p 116–124 ref

14. CLINICO-ANATOMICAL CHARACTERISTICS OF INTERAURICULAR AND INTERVENTRICULAR SEPTA DEFECTS IN CONGENITAL HEART FAULTS L. D. Krymskiy p 125–138 refs

N65-10228* National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY. A CONTINUING BIBLIOGRAPHY
Nov. 1964 130 p refs
(NASA-SP-7011(04)) OTS Price: $1.00

The subjects covered are the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the atmosphere or space. Also included are effects on biological organisms of lower order, and such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life-support

systems, exobiology, and personnel factors. Three organizations contribute to the publication—NASA, the American Institute of Aeronautics and Astronautics, and the Library of Congress. R.L.K.

N65-10255# New Hampshire U., Durham
VARIATIONS OF HUMORAL AND CELLULAR ELEMENTS OF THE BLOOD OF ALASKAN GROUND SQUIRRELS DURING HIBERNATION AND INDUCED HYPOTHERMIA
J. P. Schmidt and T. G. Metcalf Ft. Wainwright, Alaska, Arctic Aeromed. Lab., Dec. 1963 14 p refs
(Contract AF 41(609)-1856)
(AAL-TDR-63-21; AD-605253)

Alaskan ground squirrels exhibited a profound leucopenia during hibernation and hypothermia. The total number of erythrocytes declined slightly also, but the differences could not be established as statistically significant. The packed cell volume values were significantly different from normal animals only during hibernation. Hemoglobin measurements revealed a slight, though not significant, drop during hibernation. Measurements of complement titers in the serum withdrawn from active, hibernating, and hypothermic animals suggested that significant differences in complement activity did not accompany changes in body temperature during either hibernation or hypothermia. Electrophoretic patterns of sera from hibernating ground squirrels revealed the presence of a new peak in the vicinity of the beta-globulin component. Author

N65-10268# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio
THE EFFECT OF DECABORANE INJECTION ON MACACA MULATTA AND MACACA IRUS OPERANT BEHAVIOR
Herbert H. Reynolds, Henry W. Brunson (Holloman AFB, N. Mex.), Kenneth C. Back, and Anthony A. Thomas Aug. 1964 44 p refs
(AMRL-TDR-64-74; AD-607532)

Ten adult monkeys, eight on negatively, and two on positively reinforced tasks, were injected with either 2 mg, 4 mg, or 1 mg followed by 2 mg decaborane per kg body weight. Their performance on various operant tasks was compared with baseline performance. All animals exhibited a performance decrement on at least one task; 75% of the subjects exhibited a decrement on the remaining tasks. In over half the cases, performance changes preceded clinical symptoms. There was no significant difference between the 2- and 4-mg exposures when a subject showed a decrement on negatively reinforced tasks. Those subjects that received 1 mg, followed the next day by 2 mg (positively reinforced animals), did not noticeably improve or return to baseline for a much longer period than the 2-mg and 4-mg groups (negatively reinforced). Subjects exposed to these levels of decaborane may be expected to exhibit a performance decrement or clinical symptoms during the first 50 hours, since one or the other will probably occur during that time period. At lower exposure levels, tasks of a discrete nature may reflect no decrement and clinical symptoms may be absent. When performance decrements do occur, one may expect a return to baseline between 3 and 10 days. Author

N65-10285# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE EFFECT OF IONIZING RADIATION OF HEPATIC REGENERATION IN WHITE MICE AFTER BRIEF AND CHRONIC IRRADIATION
G. S. Strelin and I. V. Shiffer 7 Apr. 1964 10 p refs Transl. into ENGLISH from Eksptl. Biol. i Med. (Moscow), v. 56, no. 7, 1963 p 87–91
(FTD-TT-64-230/1+2+4; AD-600606)

This study pertains to the level of physiological regeneration of white-mice livers after partial hepatectomy, and also after the exposure to long-term and short-term radiation of Co^{60} gamma rays. It was found that a physiological regeneration occurs normally in the liver of nonirradiated adult white mice through the replacement of the cell composition by mitotic division, but that the same regeneration is strongly suppressed after irradiation. G.G.

N65-10288# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SPACE BIOLOGY—A NEW SCIENCE
H. Hurduc 1 Oct. 1964 19 p Transl. into ENGLISH from Nat., Seria Biol. (Rumania), v. 15, no. 2, 1963 p 3–12
(FTD-TT-64-664/1+3+4; AD-607307)

Progress in space biology in the Soviet Union is described. The composition of primary cosmic radiation and its intensity variation are discussed. The need for further study of the biological action of heavy nuclei is emphasized. The solution of the food and oxygen problems of manned space flight by a closed ecological system is treated. A Soviet analysis of astronomical observations indicates the existence of life on Mars. The probability of some advanced civilizations in the cosmos is noted. R.L.K.

N65-10303*# National Aeronautics and Space Administration, Washington, D.C.
REACTIVITY IN SPACE MEDICINE [K PROBLEME REAKTIVNOSTI V KOSMICHESKOY MEDITSINE]
V. V. Parin, P. V. Vasil'yev, and V. Ye. Belay Nov. 1964 17 p refs Transl. into ENGLISH of a paper Presented at the 15th Intern. Astronautical Congr., Warsaw, 7–12 Sep. 1964
(NASA-TT-F-277) OTS Prices: HC $0.50/MF $0.50

This is a study of the influence of the environment on the organism with emphasis on acceleration. It was found that acceleration changes the reactivity of several animals to various groups of drugs—anesthetics, cardiac glucosides, vasodilators, and vasoconstrictors. G.G.

N65-10306# Joint Publications Research Service, Washington, D.C.
ACUTE BLOODLETTING DURING RADIATION SICKNESS
A. A. Beysebayev 9 Nov. 1964 10 p refs Transl. into ENGLISH from Vestn. Akad. Nauk Kaz. SSR (Alma-Ata), v. 20, no. 5, 1964 p 48–53
(JPRS-27293; TT-64-51549) OTS: $1.00

Bloodletting of healthy rabbits had a stimulating effect on their hemopoietic system, and the same bloodletting performed two hours after irradiation eliminated the leukocytosis phase and did not aggrevate the leukopenia. However, when bloodletting was performed on the third and ninth postirradiation days, the course of the radiation sickness was aggravated, and there was a rise in the mortality rate and a shortening of the average survival time of the animals. G.G.

N65-10313# California U., Los Angeles School of Medicine
DESCRIPTION OF A STUDY OF ECOLOGICAL EFFECTS ON A DESERT AREA FROM CHRONIC EXPOSURE TO LOW LEVEL IONIZING RADIATION
Norman R. French Oct. 1964 59 p refs
(Contract AT(04-1)-GEN-12)
(UCLA-12-532)

A circular 20-acre study area is fenced to confine the rodent population. The area is irradiated by a Cs-137 source that

is partially shielded to reduce the dose rate at ground level close to the source. Small mammals are expected to receive about 1 R/day. Radiation dose to the kangaroo rats and pocket mice is being measured by small thermoluminescent dosimeters attached externally to the animals. Animals are individually marked. The populations of irradiated and control plots are censused at monthly intervals by live trapping. Mortality rates and production of young will be compared. Investigations of the vegetation, reptiles, and arthropods are also being conducted. Author

N65-10315*# National Aeronautics and Space Administration, Washington, D.C.

PHYSIOLOGICAL REACTIONS OF THE HUMAN ORGANISM TO TRANSVERSE ACCELERATIONS AND MEANS OF RAISING THE RESISTANCE TO SUCH FORCES [FIZIOLOGICHESKIYE REAKTSII ORGANIZMA CHELOVEKA NA POPERECHNO NAPRAVLENNYYE USKORENIYA I NEKOTORYYE PUTIPOVYSHENIYA USTOYCHIVOSTI K ETIM VOZDEYSTVIYAM]

A. S. Barer et al Nov. 1964 17 p refs Transl. into ENGLISH of a paper presented at the 15th Intern. Astronautical Congr., Warsaw, 7–12 Sep. 1964

(NASA-TT-F-274) OTS Prices: HC $0.50/MF $0.50

Three series of experiments are described. In the first, human-endurance limits to prolonged accelerations acting in the back–chest direction at a 65° angle to the longitudinal body axis were investigated, and the results were interpolated to show that a further increase in the angle (from 65° up) is accompanied by a substantial decrease in the component along the pelvis–head axis (the critical axis for human endurance) and a relatively slight increase in the component along the back–chest axis. The second study evaluated various means of raising human resistance to acceleration along the back–chest axis; the results established that optimum conditions are created when the angle between the total acceleration vector and the longitudinal body axis approaches 80°. The third study evaluated physiological changes associated with 20 to 26.5 g for 50 seconds at the 80° angle with oxygen respiration. Four stages of human response are delineated: increased activation of functional systems accompanied by an impairment of functional coordination, adaptation or resistance, disruption of adaptive reactions, and restoration when the applied force decreases. An analogy is drawn between these processes and adaptive control theory. M.P.G.

N65-10325# Federal Aviation Agency, Oklahoma City, Okla. Aviation Medical Service

EFFECTS OF SOME TRANQUILIZING, ANALEPTIC AND VASODILATING DRUGS ON PHYSICAL WORK CAPACITY AND ORTHOSTATIC TOLERANCE

R. V. Ganslen, B. Balke, F. J. Nagle, and E. E. Phillips Dec. 1963 10 p refs

(CARI-63-34; AD-603930)

A definite increase in work capacity was observed after ingestion of a combined caffeine-metrazol preparation, apparently resulting from an increased capacity for cardiac output and maximum oxygen intake. Recordil, a relatively new Italian drug and a very potent dilator of coronary arteries, also improved work capacity but caused a tendency for orthostatic syncope, probably due to its generally vasodilating effects. The blood pressure depression observed with Equanil (from the meprobamate group) during rest, exercise, and tilting, especially with larger doses, raises the question about the safety of people engaged in the operation of aircraft or motor vehicles when "sedated" by this drug. Author

N65-10337# Joint Publications Research Service, Washington, D.C.

SUPERIOR PERFORMANCE OF AGRICULTURAL AVIATION

A. Anishchenko 30 Oct. 1964 5 p Transl. into ENGLISH from Ekon. Sel'skogo Khoz. (Moscow), no. 8, Aug. 1964 p 110–113

(JPRS-27161; TT-64-51417) OTS: $1.00

The use of aircraft in agriculture in the application of pesticides, fertilizers, and weed killers is discussed. Data are presented that show the superiority of aircraft to ground means of application in terms of productivity per cost of application. P.V.E.

N65-10363*# Biosystems, Inc., Cambridge, Mass.

BIOLOGICAL CONTROL SYSTEMS—A CRITICAL REVIEW AND EVALUATION. VESTIBULAR CONTROL SYSTEM Second Quarterly Progress Report, 28 Aug.–30 Nov. 1963

[1963] 78 p refs

(Contract NAS2-1372)

(NASA-CR-59441; QPR-2) OTS Prices: HC $3.00/MF $0.75

The vestibular system is presented as a biological control system, in which contributions from the fields of psychology, physiology, anatomy, aviation medicine, and engineering are integrated. The discussion is divided into the following areas: the vestibular control system in general, anatomy and physiology of the vestibular system, behavioral experimental results related to the vestibular control system, descriptions of the control system and experiments relating to the vestibular system, and vestibular control system models. Also presented is a bibliography covering most of the literature relevant to the nonclinical aspects of the vestibular system. P.V.E.

N65-10409# Naval Air Development Center, Johnsville, Pa. Aviation Medical Acceleration Lab.

DISPLACEMENT AND DURATIONAL CHARACTERISTICS OF LEVER PRESSING UNDER A VARIABLE RATIO SCHEDULE AND SUBSEQUENT EXTINCTION

Robert M. Herrick and Richard A. Bromberger 17 Sep. 1964 31 p refs

(NADC-ML-6409; AD-450289)

Compared with other schedules, mean lever displacement and variability of rats under a VR schedule was high. Displacement distributions in VR correlated with distributions in extinction. As a function of the ordinal number of the press following a reinforcement, no behavioral pattern emerged. No tendency to repeat a reinforced response existed, but there was, initially, a tendency to repeat a nonreinforced response. Median response durations and interresponse times in extinction remained about the same as in acquisition, but extreme values occurred more frequently. A number of differences between VR and FR behavior were noted; none of these differences were discernible from rate measurements. Author

N65-10466# Aerospace Medical Div. Aeromedical Research Lab. (6571st), Holloman AFB, N. Mex.

REACTION TIME OF THE PRE-ADOLESCENT CHIMPANZEE (UNDER CONDITIONS OF NEGATIVE REINFORCEMENT)

Herbert H. Reynolds, Donald L. Hay, and Vernon Pegram Sep. 1964 24 p refs

(ARL-TR-64-10; AD-450472)

An "allowable interval" for responding has been arbitrarily used in animal reaction time studies, having no empirical basis in systematic investigations of an animal's optimal response

capability. The comparative psychology research program of this laboratory has made great use of such a procedure, employing the preadolescent chimpanzee as a surrogate for man in potentially high risk situations. However, it was felt that a need existed to know more about the optimal discrete response characteristics of the chimpanzee, with regard to both single and multiple stimuli. The results, in which negative reinforcement (low amperage shock) was used, indicate that the reaction time of the preadolescent chimpanzee in an experimental situation approximating that of routine laboratory performance testing is highly similar to that of man. In programing tasks that involve single or multiple stimuli to which a discrete response must be made, suggestions are made concerning the allowable time interval for responding. Author

N65-10467# Chicago Medical School, Ill.
BODY TISSUE CHANGES IN DOGS RESULTING FROM SINUSOIDAL OSCILLATION STRESS Technical Documentary Report, Mar. 1960–Dec. 1962
John L. Nickerson and Anna Paradijeff Wright-Patterson AFB, Ohio, AMRL, Aug. 1964 27 p refs
(Contract AF 33(616)-7053)
(AMRL-TDR-64-58; AD-435550) OTS: $2.00

This is a report on tissue damage resulting from varying frequency, amplitude, and duration of sinusoidal vibration. Gross post mortem and histological observations and, in some cases, routine clinical studies of blood and urine were made. The organs found most liable to damage with vibration at 4 cps as evidenced by hemorrhage observed in histological studies were kidney, midbrain pons, heart, lungs, and liver, with less effect upon the urinary bladder, medulla, rectum, and trachea. At the higher frequencies the pituitary, stomach, duodenum, pancreas, and the midbrain also showed change. The adrenal, spleen, and sections of artery showed no histologic evidence of hemorrhage in the tests performed. Tearing occurred in soft tissues. No ligaments showed damage. Blood cell changes appeared, specifically hyperlobulation in the polynuclear neutrophils, inhomogeneities, and the appearance of intranuclear vacuoles in the nucleus of the lymphocytes. Author

N65-10497# Naval Research Lab., Washington, D.C. Chemistry Div.
EFFECT OF HIGH MAGNETIC FIELDS ON RESPIRATION AND PHOTOSYNTHESIS IN ALGAE
P. J. Hannan 15 Sep. 1964 11 p refs
(NRL-6153; AD-606952)

An algal culture apparatus was designed to fit inside the 2 1/2-in. bore of a large electromagnet capable of providing fields exceeding 100 000 G. Photosynthesis and respiration rates of *Chlorella pyrenoidosa* (7-11-05) were determined by analyzing the input and effluent gases for oxygen. Two experiments were conducted: (1) the effect of 10 000 G on photosynthesis; and (2) the effect of 100 000 G on respiration. In neither case did the magnetic field have any effect. Author

N65-10623# Massachusetts Inst. of Tech., Cambridge
EFFECT OF STRESS OF NUTRIENT REQUIREMENTS OF MAN Progress Report, Nov. 1, 1962–Oct. 31, 1963
Nevin S. Scrimshaw [1963] 105 p refs
(Contract DA-49-193-MD-2239)
(AD-423385) OTS: $2.50

The major experimental projects completed during the year involved three studies upon the physiological effect of the reversal of night and day, and two studies on the effect of examinations. Subjects were evaluated psychiatrically in all trials: in two of the reversal studies and one of the examination studies psychiatric interviews were performed, in addition to the physiological and biochemical measurements. Weights and pulse rates were examined, and urines and fecal samples were analyzed. Two studies involving two groups of five students showed that when such individuals were subjected to a reversal of night and day, accompanied by an obligation to work during such reversed periods, there was enhanced excretion of nitrogen, inorganic sulfate sulfur, and during the reversal periods these were paralleled by the excretion of 17-hydroxysteroids; very little effect was observed on the excretion of creatinine, sodium, and potassium. A third reversal study involving 10 students for a 21-day period was also completed. Here, the days following a return to a normal day and night pattern were also examined. Author

N65-10653# Joint Publications Research Service, Washington, D.C.
BLASTOMATOGENIC ACTION OF HIGH-ENERGY PROTONS
V. N. Strel'tsova, Yu. I. Moskalev, and I. K. Petrovich 13 Nov. 1964 6 p ref Transl. into ENGLISH from Vopr. Onkol. (Leningrad), v. 10, no. 9, 1964 p 74–76
(JPRS-27343; TT-64-51599) OTS: $1.00

This is a report on the blastomatogenic effects on Wistar rats of high-energy protons, in doses ranging from 25 to 850 rads. The rats were irradiated in a synchrocyclotron. All animals were then dissected, and the nature and type of the tumor process were observed. It was found that benign and malignant tumors developed in a variety of tissues, but were found chiefly in the endocrine glands, the sex organs, and the mammary glands. The total frequency of tumors and the number of cases of polycentric origin of neoplasma were found to be higher in the female than in the male Wistar rats. G.G.

N65-10675# Oak Ridge National Lab., Tenn.
PARTICLE REENTRY INTERACTIONS
Ralph S. Decker, Jr. and Morton I. Goldman (Nuclear Utility Services, Inc. Washington, D.C.) 20 Jan. 1964 30 p refs

A reevaluation of the radiological problems associated with the premature reentry of fragments of a high-power density nuclear-rocket reactor is presented, based on recently acquired data. Interaction probabilities are considered for four types of potential exposures: external whole-body gamma doses, beta skin doses, lung doses, and gastrointestinal-tract doses. M.P.G.

N65-10677# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MEASURING THE DOSES OF RADIATION RECEIVED BY Yu. A. GAGARIN AND G. S. TITOV AT THE TIME FOR FIRST SPACE FLIGHTS
I. B. Keirim-Markus, Ye. Ye. Kovalev et al 6 Nov. 1963 5 p refs Transl. into ENGLISH from Iskusstv. Sputniki Zemli (Moscow), no. 15, 1963 p 102–103
(FTD-TT-63-1017/1; AD-424605)

Photodosimeters (IFKN) to register neutrons and gamma rays, and luminescent dosimeters (ILK) to register gamma rays and protons were used by the Russian cosmonauts on their space flights. The received dose of radiation consisted basically of primary cosmic radiation amounting to 6 to 10 mrad/day. The gathered data were compared with each other, and the difference in the indications of the dosimeters with different filters, explained as radiation retardation, incurred by the spaceships passing through the outer radiation belt in the region of the South Atlantic anomaly. By observation of the data gained by PKI, it was assumed that the radiation of solar flares did not

bring any noticeable increase to the accumulated radiation dose, and that the radiation effect on the astronauts did not go over 60 mber, and so was judged negligible. G.G.

N65-10880# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
RESPONSE TO SECONDARY ANTIGENIC STIMULUS AFTER WHOLE BODY X-IRRADIATION IN THE BEAGLE
F. F. Pindak, J. F. Stara (Public Health Service, Cincinnati), and W. E. Clapper Sep. 1964 15 p refs
(Contract AT(29-2)-1013)
(LF-17) OTS: $0.50

The results of the administration to healthy beagles of a secondary antigenic stimulus (booster dose) of *Leptospira canicola* and infectious canine hepatitis virus (ICH) are reported. Twelve previously vaccinated animals were used. Six were exposed to 335 R dose of X-irradiation. Three controls and three irradiated dogs received the booster dose two days after the irradiation, and the remaining six, seven days later. Agglutinin titers for *Leptospira canicola* of 1:32 to 1:256 were observed in the 12 beagles before the booster dose. No increases of significance were found in either the controls or the experimental group after the booster dose. Complement-fixing titers for the ICH virus of 1:16 to 1:64 were seen in all animals before revaccination. There was no significant difference in the titers of the control group and the experimental group that were given the ICH booster seven days after irradiation. However, the response observed in the controls given the booster after two days was absent in the irradiated animals. Author

05 BIOTECHNOLOGY

Includes life support systems, human engineering, crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N65-10014# Boeing Co., Seattle, Wash.
EFFECTS OF MISCELLANEOUS WASTES ON MESOPHILIC ACTIVATED SLUDGE: SOAPS, DETERGENTS, AND VOMITUS
R. W. Okey, R. L. Cohen, and D. D. Chapman Brooks AFB, Tex., School of Aerospace Med., Aug. 1964 13 p refs
(Contract AF 41(657)-387)
(SAM-TDR-64-41; AD-449425)

Effects of soap, synthetic detergents, and vomitus on the performance of high solids, mesophilic-activated-sludge, biologic-type waste reactors designed for extended manned space flight are reported. System performance was determined by oxygen uptake measured by microrespirometer and degree of side effects. Castile soap and the detergent sodium dodecyl sulfate were metabolized rapidly, and no deleterious side effects were exhibited. Eight other cleansing agents had serious disadvantages due to slow biodegradability or extreme foaming, or both. The relationship between biodegradability and chemical structure of the nonionic and anionic synthetic detergents is discussed. Human stomach content of nonpathologic origin was found to be rapidly metabolized, and pH depression that results from the discharge of vomitus through a waste treatment system had only slight observable metabolic effect through pH 4. The disposal of selected cleansing agents, vomitus, and pH depressant substances posed no apparent problems. Author

N65-10035# Joint Publications Research Service, Washington, D.C.
SIMULATED SPACE FLIGHT EXPERIMENTS
9 Nov. 1964 12 p Transl. into ENGLISH from Med. Gazeta (Moscow), no. 75, 18 Sep. 1964 p 3; no. 80, 6 Oct. 1964 (JPRS-27286; TT-64-51542) OTS: $1.00

CONTENTS:
1. MAN IN A SPACE VEHICLE Z. Lebedinskiy, S. Levinskiy, and Yu. Nefedov p 1–5
2. IN AN ARTIFICIAL ATMOSPHERE A. Kuznetsov, N. Agadzhanyan, and S. Zharov p 6–9

N65-10036 Joint Publications Research Service, Washington, D.C.
STATISTICAL ELECTROENCEPHALOGRAPH MODEL
M. I. Venslauskas et al 12 Nov. 1964 15 p refs Transl. into ENGLISH from Zh. Vysshei Nervnoi Deyatel'Nosti (Moscow), v. 14, no. 4, Jul.–Aug. 1964 p 726–731
(JPRS-27324; TT-64-51580) OTS: $1.00

This is a description of a statistical EEG model to be used for the explanation of the quantitative characteristics of the EEG as a function of the physiological load. It was assumed that the EEG represents a sum of the random electric activity of neurons correlated to a concrete physiological mechanism in which the singled-out rhythms of the alpha-rhythm type are absent from the EEG. The mechanism of the formation and development of the wave impulses was established by equations. It was found that the proposed statistical model of excitation waves in a mass of neurons is in agreement with the basic experimental facts that are characteristic in EEG dynamics. G.G.

N65-10045*# Naval School of Aviation Medicine, Pensacola, Fla.
BIOLOGICAL CONSIDERATIONS OF MANNED SPACE FLIGHT
Ashton Graybiel [1964] 11 p refs
(NASA Order R-93)
(NASA-CR-59405) OTS Prices: HC $1.00/MF $0.50

This paper covers the stresses and hazards in manned space flight that are originated by the great distances to be transversed, the lack of any known destinations having a favorable environment, the exposure to a near vacuum, and the changes in the gravitoinertial force of the environment. The application of hyoscine or a combination of hyoscine and d-amphetamine was found to give the best protection against motion sickness induced by prolonged rotation. G.G.

N65-10218# Naval School of Aviation Medicine, Pensacola, Fla.
AN INSTRUMENT FOR ELECTROCARDIOGRAPHIC AREA MEASUREMENTS
Thomas G. Arnold, Jr. (Vanderbilt U.) and Raphael F. Smith 26 May 1964 15 p refs
(Rept.-1; AD-253064)

The report describes an instrument that has been developed to measure the area of electrocardiographic deflections. Basically, the instrument is a special purpose analog computer that performs the mathematical operation of integration on three

input signals. Synchronizing circuits have been added to start the period of integration at a predetermined time in the cardiac cycle. The instrument is an essential component in a system used to quantitate the ECG changes that occur after excercise.
Author

N65-10230# American Inst. for Research, Pittsburgh, Pa.
THE INVESTIGATION OF STEP SIZE AND ERROR RATE IN PROGRAMMED INSTRUCTION
David J. Klaus Jul. 1964 108 p refs
(Contract N61339-1208)
(NAVTRADEVCEN-1208-1; AD-607782)

An investigation was undertaken to determine whether step size in linear programs could be defined, measured, and manipulated, and to determine the effects of various sizes of step on error rate and achievement for learners at three levels of ability. Response, cue, context, and enrichment components of a frame were used to define both intraframe and interframe step size. Numerical scales then were developed to measure step size, and a set of manipulations was devised for use in modifying the step size of existing programs. Normative step-size values were determined from a survey of 10 published programs.
Author

N65-10260# Naval Training Device Center, Port Washington, N.Y. Human Factors Lab.
THE EFFECTS OF STIMULUS AND FIELD SIZE ON THE ACCURACY OF ORIENTATION IN THE HOMOGENEOUS ENVIRONMENT
Milton S. Katz, William Metlay, and Paul A. Cirincione Jul. 1964 31 p refs
(NAVTRADEVCEN-IH-13; AD-607739)

The effects of various size targets and the extent of the visual field on the accuracy of orientation in the homogeneous environment were investigated by requiring S's to reposition, to geometric center, four different targets starting from 11 locations, in a 270° homogeneous field. Among the results are the following: (1) Each S positioned all four targets into a preferred field. (2) Small error scores and consistency in positioning around perceived centers were found with only three of the four targets. (3) In all cases, the largest error and greatest variability was in centering the smallest target. (4) Absolute errors were not related in any systematic fashion to the initial starting points.
Author

N65-10267# Amoco Chemicals Corp., Seymour, Ind.
A SOLID CHEMICAL AIR GENERATOR Final Report, Apr. 1963–Mar. 1964
Gavin H. Peters, James E. Aker, and E. F. Morello Wright-Patterson AFB, Ohio, AMRL, Sep. 1964 57 p
(Contract AF 33(657)-11120)
(AG-1; AMRL-TDR-64-71; AD-607480)

The development of a solid chemical air generator capable of producing a breathable, oxygen-enriched atmosphere for possible space applications was investigated. Various catalyst systems for decomposition of nitrous oxide were investigated, since the reaction products contained about 40% of this gas and results indicated this gas could be controlled. Screening of various catalyst systems produced nickel oxide, 0.5% rhodium on alumina, 0.6% platinum on alumina, and cobalt oxide catalysts, all capable of completely decomposing nitrous oxide at high flow rates. The level of nitrous oxide in the reaction products could not be increased sufficiently to provide the desired oxygen level, and it was necessary to decompose the nitrogen dioxide present in the reaction gases.
Author

N65-10269# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio
A FURTHER STUDY OF THE INFLUENCE OF A RELEVANT BUT "UNUSED" CUE IN TRAINING UPON TRANSFER IN A POSITIVE TRANSFER SITUATION
Gordon A. Eckstrand, Alan D. Neiberg, and Ross. L. Morgan Sep. 1964 13 p refs
(AMRL-TDR-64-81; AD-607472)

This study was an attempt to assess the utility of a cue that was relevant to, but not used in, the solution of a first task in the learning of a second task. The relationship was such that if something were learned about the relevant but "unused" cue, positive transfer would be expected to occur. In an earlier experiment, no positive transfer was found in this type of situation. The present study essentially duplicated the first but involved an important procedural modification. This modification was intended to rule out the possibility that subjects in the first study had been trained to disregard this relevant but unused cue. The findings of the present study support those of the earlier one. Even with the revised procedure, no transfer was shown from the learning of the first task to the learning of the second task, on the basis of the cue that was originally relevant but unused.
Author

N65-10284# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ELECTRICAL MEASUREMENT OF MECHANICAL QUANTITIES IN PHYSIOLOGICAL INVESTIGATIONS
Ye. B. Babskiy and Ya. S. Yakobson 23 Mar. 1964 17 p Transl. into ENGLISH from the book "Elektronika v Meditsine" Moscow, Gosenergoizdat, 1960 p 79–90
(FTD-TT-63-1192/1+4; AD-600613)

Considered is the application of transducers that convert mechanical quantities directly into electrical signals. Energetic or generator transducers include the piezoelectric transducer used for recording rapid dynamic processes, and the magneto-electric transducer used with the direct ballistocardiograph. Parametric transducers are characterized by the fact that one of the transducer's inherent electrical properties is altered by the influence of various mechanical quantities. The uses of capacitance, inductance, resistance, semiconductor, and resistance wire transducers, some in technically new physiological procedures, are described. The application of these methods affords the possibility, by using an oscilloscope as a recording device, of carrying out vector analysis of various motor phenomena. Also, using electronic differentiating and integrating circuits, it is possible to synchronously record the first and second derivatives, as well as the integral, of the functions expressing any curve. This permits simultaneous recording, using one transducer, of displacements, speeds, and accelerations characterizing some processes.
R.L.K.

N65-10496# Air Force Office of Scientific Research, Washington, D.C.
THE AIR FORCE-OAR CONTRIBUTION TO PROGRAMMED INSTRUCTION Monographs, No. 1
S. V. Martorana Aug. 1964 15 p refs
(OAR-64-10; AD-607073)

The influence of the new educational method of programed instructions on the instructional and training methods in military fields is discussed. The improvement in the effective utilization of the human capabilities by the use of autoinstructional devices is observed. The human element, as the most important "weapon," develops a higher effectiveness and so enhances the chances of success for the total military organization.
G.G.

N65-10509# Naval School of Aviation Medicine, Pensacola, Fla. Naval Aviation Medical Center
THE RELATIONSHIPS AMONG THE NEEDS AND VALUES OF FLIGHT CANDIDATES Research Report
Lawrence K. Waters 16 Apr. 1964 11 p refs
(Rept.-39; AD-604535)

The purpose of this study was to determine for a cadet sample the relationships among the scales of two forced-choice personality instruments and to compare these relationships with those previously reported for college students. Mean scale scores for the flight candidate sample were also compared with college male norms. The scale relationships were very similar to those found for college samples. Several differences between cadet and college male groups were found on mean scale scores. Author

N65-10522# General Dynamics Corp., Groton, Conn. Electric Boat Div.
BEHAVIORAL AND OPERATIONAL ASPECTS OF TACTICAL DECISION MAKING IN AAW AND ASW
Raymond C. Sidorsky, Joan F. Houseman, and David E. Ferguson Port Washington, N.Y., Naval Training Device Center, Aug. 1964 112 p refs
(Contract N61339-1329)
(NAVTRADEVCEN-1329-1; AD-607888)

This report describes a continuing analytical and empirical research program intended to provide data related to those aspects of decision-making behavior that can be trained. The study included the delineation of the organization and responsibilities of AAW and ASW personnel as well as the development of ACADIA—a taxonomy of tactical decision tasks. Purposes to be served by the ACADIA schema include the isolation and identification of general decision-making skills and the development of training procedures and methods through which general decision-making skills can be developed. Several behavioral traits are discussed in regard to their applicability to the derivation of generalized behavioral criteria. These traits include stereotypy, perseveration, timeliness, completeness, and series consistency. Also discussed is the notion of a Decision Response Evaluation Matrix, a technique that might make it possible to rate or score the adequacy of a decision response in terms of various operational criteria such as spatial relationships, self-concealment, conservation of resources, information generation, and weapon utilization. Author

N65-10641*# National Aeronautics and Space Administration, Washington, D.C.
EFFECTS OF GRAVITY ON BODY FUNCTIONS AND PROBLEMS OF SPACE FLIGHT [GRAVITATSIONNYYE VOZDEYSTVIYA V FORMIROVANII FUNKTSIY ORGANIZMA I PROBLEMY KOSMICHESKIKH POLETOV]
P. K. Isakov, Ye. M. Yuganov, and I. I. Kas'yan Nov. 1964 7 p refs Transl. into ENGLISH of a paper presented at the 15th Intern. Astronautical Congr., Warsaw, 7–12 Sep. 1964
(NASA-TT-F-275) OTS Prices: HC $0.50/MF $0.50

Since no generalized theory exists explaining the action of weightlessness on the human body, some determinations of the effects of acceleration and weightlessness on the body and on the functioning of organs and systems are analyzed in an effort to assemble basic concepts for such a theory. Included are the following: (1) The differential threshold of perception of gravitational force decreases during weightlessness. (2) A change in the weight of the hand during acceleration or weightlessness impairs the coordinated functioning of the epidermal and motor analyzers in estimating the weight of objects. (3) The degree of skeletal muscle tonicity during acceleration and weightlessness differs from normal values. (4) Weightlessness results in a level of otolithic stimulation manifested by a lower excitability of the semicircular canals, as compared with their excitability under terrestrial or acceleration conditions. (5) In all probability, the level of gas metabolism processes will be lower in weightlessness than under terrestrial conditions. M.P.G.

N65-10648# Human Sciences Research, Inc., McLean, Va.
AIRPORT/HELIPORT MARKING AND LIGHTING SYSTEMS: A SUMMARY REPORT ON HUMAN FACTORS RESEARCH Final Report
J. A. Whittenburg, W. S. Vaughan, Jr., M. D. Havron, and C. R. Cavonius Jun. 1964 29 p refs
(Contract FAA/BRD-401)
(RD-64-94; HSR-RR-64/2-Mk-X)

This is a study of human-factors considerations in airport and heliport marking and lighting systems. Surveys of prior operational flight tests, human-factor data, and all marking and lighting components and systems are presented. Studies of the development of the airport and heliport marking and lighting designs, as well as their screening and evaluation, are discussed. The communality of the marking and guidance requirements for fixed- versus rotary-wing aircraft, and the allocation of the research, logistical, and operational resources in regard to future marking and lighting requirements were also observed. G.G.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N65-10011# Princeton U., N.J. Frick Chemical Lab.
POLYMER SULFUR AND OTHER POLYSULFIDE POLYMERS
Arthur V. Tobolsky Jun. 1964 15 p refs
(Contract Nonr-1853(07))
(ONR-TR-RLT-80; AD-601360)

Polymeric sulfur changes to rhombic sulfur at 90° C, and the specific rate constant for the cleavage of the polysulfide linkage were obtained from studies of organic polysulfide polymers. Emphasis is placed on the super-cooled liquid state of the ring structure S_8. The great lability of the polysulfide linkage explains the rapid establishment of the ring chain equilibria and the sulfur reactivity with other substances G.G.

N65-10213# Western Reserve U., Cleveland, Ohio Ultrasonics Research Lab.
STUDIES OF RELAXATION EFFECTS IN ELECTROLYTIC SOLUTIONS WITH THE PRESSURE-STEP METHOD
Heinz Hoffmann, John Stuehr, and Ernest Yeager 15 Jun. 1964 47 p refs
(Contract Nonr-1439(04))
(TR-27; AD-604113)

A pressure-step apparatus is described that permits the measurement of relaxation times of chemical processes involving ionic equilibria. The method involves the sudden

release of an applied static pressure (~30 atm) on an electrolytic solution. After the pressure release, the reestablishment of equilibrium between free hydrated ions and associated species is followed by means of conductance measurements. The relaxation time τ is observed directly from a display of the conductance changes on an oscilloscope screen. Relaxation times longer than 20μsec can be measured with this apparatus. The method has been applied to the study of complex formation between polyvalent cations and various ligands (e.g., sulfate, malonate, glycollate, glycinate, acetate). Relaxation times ranging from about 100μsec to several seconds were measured. Author

N65-10227# Bureau of Mines, Albany, Ore. Albany Metallurgy Research Center
A PROCESS FOR THE PREPARATION OF THORIUM BY SODIUM REDUCTION OF THORIUM TETRACHLORIDE
H. O. Poppleton and F. E. Block 1964 25 p refs
(BM-RI-6527)

This investigation was made to develop a method of preparing high-purity thorium metal in quantities up to 20 kg per batch. Thorium tetrachloride was prepared by chlorination of decomposed thorium nitrate or oxalate with carbon tetrachloride or phosgene. Purification of the crude tetrachloride was achieved by multiple distillations or by filtration of the molten chloride. High-purity thorium metal can be prepared by sodium reduction of thorium tetrachloride if chloride of sufficient purity is available. Byproduct salts and excess reductant were removed by vacuum distillation, and the resultant thorium metal sponge was consolidated by consumable-electrode or fixed-electrode arc melting. Metal prepared by this method can be fabricated into bar, rod, or sheet, at room temperature. Author

N65-10231# Brussels U. (Belgium)
VAPORIZATION OF COMPOUNDS AND ALLOYS AT HIGH TEMPERATURES. PART XXIII: THERMOCHEMICAL STUDY OF THE GERMANIUM OXIDES USING A MASS SPECTROMETER—THE DISSOCIATION ENERGY OF THE MOLECULE GeO
J. Drowart, F. Degreve, G. Verhaegen, and R. Colin Wright-Patterson AFB, Ohio, AF Mater. Lab., Sep. 1964 34 p refs
(Contract AF 61(052)-225)
(WADD-TR-60-782, Pt. XXIII; AD-607511)

The mass spectrometric study of the vaporization of the compounds GeO_2(hex) and GeO(am) and of the mixture GeO_2(hex) + Ge(c) made it possible to establish their mode of vaporization: $GeO_2(hex) \rightarrow GeO(g) + 1/2O_2$; n GeO(am) $\rightarrow (GeO)_n(g)$(n = 1, 2, 3); and n/2 GeO_2(hex) + n/2 Ge(c) $\rightarrow (GeO)_n(g)$(n = 1, 2, 3.). The enthalpies of vaporization and the polymerization energies are given. Total pressures given in the literature were reinterpreted taking the presence of the polymers into account. Author

N65-10245# Stauffer Chemical Co., Richmond, Calif. Richmond Research Center
HIGH ENERGY OXIDIZERS Second Quarterly Technical Summary Report, 1 May–1 Aug. 1964
K. O. Christe and A. E. Pavlath 25 Aug. 1964 9 p refs
(Contract Nonr-4019(00); ARPA Order 399-62)
(AD-605163)

The reaction of nitrogen pentoxide and chlorinetrifluoride did not result in the desired $ClF_2^+NO_3^-$. The main product isolated was nitrylfluoride. The small amount of residue obtained did not contain chlorine in any valency state. When chlorinetrifluoride reacted with fuming nitric acid, no $ClF_2^+NO_3^-$ could be detected. A solid residue of low thermal stability was obtained, which also did not contain any chlorine. In the vapor phase the presence of ClO_2F was established. The reaction between NOF and ClF gave a solid complex at −78° C, which rapidly decomposed at slightly higher temperatures. No complex formation was observed between ClO_3F and ClF in the range of −78° C to room temperature. Author

N65-10252# Ohio State U. Research Foundation, Columbus
TOTAL ABSORPTANCE OF AMMONIA IN THE INFRARED Scientific Report No. 1
Wilbur L. France and Dudley Williams (North Carolina State Coll.) Jul. 1964 108 p refs Report completed at North Carolina State Coll.
(Contracts AF 19(604)-6141; AF 19(628)-3898)
(AFCRL-64-652; AD-607401)

Apparatus and experimental techniques used in the measurement of the total absorptance $\int A(\nu)d\nu$ of the ammonia bands near 950, 1628, and 3300 cm^{-1} are described. The total absorptances of these bands at 25° C have been measured for pure samples of ammonia and for ammonia mixed with nitrogen. The results are displayed graphically with total absorptance shown as a function of absorber concentration w and equivalent pressure P_e that depends upon the partial pressures of the two gases. The graphs are used in predicting total absorptance of ammonia in any sample for which the values of w and P_e are known, provided these values lie within the range studied. The experimental values of partial pressure, total pressure, and $\int A(\nu)d\nu$ are tabulated, and tracings of many of the spectra are shown. Values for intensity are given for each region studied. The equivalent pressure P_3 is expressed as a function of the self-broadening coefficient B that is related by simple kinetic theory to the ratio of the optical collision diameters. These derived ratios are listed. Author

N65-10257# United Nuclear Corp., White Plains, N.Y. Development Div.
ELECTROLYTIC REMOVAL OF OXYGEN FROM SODIUM Technical Documentary Report, Aug. 8, 1963–Jun. 30, 1964
J. M. Mc Kee Wright-Patterson AFB, Ohio, AF Aero Propulsion Lab., Aug. 1964 62 p refs
(Contract AF 33(615)-1039)
(APL-TDR-64-93; AD-608042)

Dissolved oxygen was extracted from flowing sodium by ionic transport through an impervious solid electrolyte wall. Current efficiency and cell resistivity were measured for three solid oxide electrolytes at several temperatures and voltages. Best results were obtained with ZrO_2 + 8 m/o CaO at 1200° F and 4 to 6 V/mm. Current efficiency was low, due to induced electronic conduction, but oxygen removal rates higher than in zirconium hot traps were achieved. Similar cells tested in pure oxygen at the same temperature also developed electronic conduction. Application of such cells to aerospace sodium systems is hindered by the unpredictable life of the ceramic tube. A modified cell concept, substituting an oxide film on a metallic substrate for the free-standing ceramic tube, is described. Author

N65-10308# Battelle Memorial Inst., Columbus, Ohio
DEVELOPMENT OF ANALYTICAL TECHNIQUES FOR THE DETERMINATION OF MINUTE QUANTITIES OF SELECTED ELEMENTS IN BERYLLIUM Interim Report, 20 Mar.–20 May 1964
W. M. Henry 24 Jun. 1964 20 p
(Contract NOw-64-0081-c)
(IR-2; AD-603756)

Investigations were made to evaluate, especially in respect to trace-gas impurities, different methods of cleaning sample electrodes, of loading into the mass spectrograph, and of baking prior to mass-spectrographic analysis. Conclusions on the effectiveness of the various procedures are tentative. Author

N65-10319# Atomic Energy Commission, Washington, D.C. Div. of Technical Information
BERYLLIUM OXIDE PROPERTIES AND APPLICATIONS
Remir Aleksandrovich Belyaev Nov. 1964 261 p refs Transl. into ENGLISH of the book "Okis' Berilliya. Svoistva i Primeneniye" Moscow, 1962 239 p
(AEC-TR-6175) OTS: $6.00

This survey of Soviet and foreign literature up to the end of 1961 treats the production of beryllium oxide and of BeO parts, and the properties and uses of the oxide. R.L.K.

N65-10351 Southwest Research Inst., San Antonio, Tex.
A STUDY OF RAPID SOLIDIFICATION OF HYDROCARBON FUELS Progress Report, Apr. 1–May 1, 1964
E. C. Martin 15 May 1964 19 p
(Contract DA-44-177-TC-819(T))
(AD-447828)

This is an evaluation study of several new diisocyanates and amines, and the rapid solidification ability of the JP-4 fuel. The following topics are presented: "Polyureas as Gelling Agents"—aromatic diisocyantes and aromatic amines; "Temperature Limits for Various Gelling Systems"; "Gel Rigidity"; "Gel Performance Under Impact"—some gels did not lose any fuel under impact; and "Comparison of Gelled Jet Fuels"—4-chlorobenzylamine and m-xylylene diisocyanate were found to gel JP-4 fuel in less than 1.0 second. G.G.

N65-10356# Atomics International, Canoga Park, Calif.
REPROCESSING OF URANIUM CARBIDE BY A NITRIDE–CARBIDE CYCLE. 1: KINETICS OF NITRIDE FORMATION
L. A. Hanson 31 Oct. 1963 38 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-8388) OTS: $0.75

The reaction of uranium carbide with nitrogen was investigated in relation to the effects of UC age (time of UC exposure to air saturated with water vapor at room temperature) in the range from 0 to 120 days, initial UC particle size from 4 mesh to less than 400 mesh, UC composition from 3.59 to 5.55 wt% carbon, nitrogen pressure from 10- to 600-mm Hg absolute, and reaction temperature from 550° to 1050° C. The reaction changes the UC to a powder consisting of a mixture of carbon and uranium nitrides; the principal nitride phase was identified as U_2N_3. Author

N65-10358# Victoria U. of Manchester (Gt. Brit.)
THE THERMOCHEMISTRY OF ALKYLS OF TIN AND GERMANIUM, OCTOBER–DECEMBER 1963
A. E. Pope, W. V. Farrar, G. A. Nash, and H. A. Skinner 31 Dec. 1963 12 p refs
(Contract DA-91-591-EUC-3095)
(QTSR-1; AD-442716)

General studies were continued on di(tertiarybutyl)tin, and it was established that the crystalline material is tetrameric, $(Sn\text{-}tBu_2)_4$, and presumably is a cyclic tetramer. The investigation of the heats of redistribution of SnR_4 with $SnCl_4$ was furthered by the modification and improvement of the calorimeter and by the application of gas chromatography as a means of analysis of the alkyl tin chlorides investigated. Results from an investigation of the heat of combustion of tetrabutyl germanium are not conclusive, mainly because recovery of CO_2 was low. A short paper on the studies of di(tertiarybutyl)tin is included. D.E.W.

N65-10433# Texas U., Austin Environmental Health Engineering Research Lab.
RADIOACTIVITY TRANSPORT IN WATER—ENVIRONMENTAL BEHAVIOR OF NITROSYLRUTHENIUM Technical Report No. 3
Albert H. Story and E. F. Gloyna 1 Jun. 1963 103 p refs
(Contract AT(11-1)-490)
(ORO-620) OTS: $2.25

Nitrate and nitrite complexes of nitrosylruthenium were prepared and identified by paper-partition chromatographic techniques. These materials were subjected to various conditions simulating changes in an aquatic environment, namely, variations in pH, chlorides, and sulfides. Ionic characteristics of the various complexes were evaluated with the aid of ion-exchange resins. The affinity of nitrosylruthenium complexes for clays, bottom sediments, and organic debris was investigated. The effects of chlorides, sulfides, hydrogen-ion concentrations, and various cations on exchange behavior of the nitrosylruthenium complexes were investigated. Intermediate and end products were determined by use of paper-partition chromatography, absorption spectroscopy, radioactive isotope tracers, X-ray diffraction, and chemical analyses. Author

N65-10435# Atomics International, Canoga Park, Calif.
RADIOLYSIS PRODUCTS OF POLYPHENYL COOLANTS. PART III: OMRE HIGH BOILERS
R. T. Keen, W. L. Orr, L. J. Miller, R. J. Sullivan, and R. C. Shepard 15 Oct. 1964 95 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-9731)

The nature of the high boiling radiolysis products of OMRE coolants was studied extensively. The high boilers are a complex mixture of polyphenyls, with smaller amounts of triphenylenes, phenanthrenes, and other minor radiolysis products. These mixtures have been characterized by mass spectral examination in the mass range from 226 to 686 and by number-average molecular weight determinations. Results of this study show that with continued exposure to radiation the number-average molecular weight of the high boilers increases and that the amount of material of mass > 686 also increases. The more volatile components of the high boilers were examined by gas-liquid chromatography. Decomposition products through p-quinquephenyl were determined. The less volatile high boilers, called nondistillable high boilers, were partially separated by adsorption chromatography on alumina. Author

N65-10577# Hebrew U., Jerusalem (Israel)
RESEARCH ON SOLID STATE CHEMICAL REACTIONS Technical (Final) Report
S. Patai, M. Weinstein, and D. Amar Wright-Patterson AFB, Ohio, ARL, Sep. 1963 39 p refs
(Contract AF 61(052)-575)
(ARL-63-218; AD-423174)

This report describes the investigation of the solid-solid oxidation of synthetic diamond and synthetic graphite by potassium perchlorate in the presence and absence of catalysts. It also describes the oxidation reaction of high-melting organic compounds by potassium chlorate in the presence and absence of various catalysts. Author

N65-10595 Library of Congress, Washington, D.C. Aerospace Technology Div.
FLUORIDES AND OXYFLUORIDES OF CHLORINE Review Article
10 Nov. 1964 10 p refs
(ATD-P-64-61)

Results are given of an analysis of a 1962 article by G. N. Bogachov to determine the following: (1) the real name of the new compound "perftorkhlorid" mentioned in the article; and (2) if any indications exist in Soviet literature for higher fluorides of chlorine other than ClF_3. The analyst concludes that the compound mentioned in the article is perchloryl fluoride, probably of American origin. It is impossible to determine the answer to (2), but as late as 1963, a Soviet source mentioned ClF_3 as the highest of halogen fluorides in connection with rocket fuels. M.P.G.

N65-10609# Manchester Coll. of Science and Tech. (Gt. Brit.)
RESEARCH ON PROBLEMS OF RESTRICTED ROTATION RELEVANT TO INORGANIC POLYMERS Technical (Final) Summary, 1 Oct. 1960–31 May 1963
Michael F. Lappert 29 Jun. 1963 47 p refs
(Contract AF 61(052)-441)

Evidence from nuclear magnetic resonance studies for π-bonding between boron and nitrogen in the borazens is presented. Preliminary experiments, by infrared spectroscopy, which indicate that a similar situation might exist between phosphorus (III) and nitrogen in open chain compounds, are reported. The energy barrier to rotation about the BN bond in dimethylaminophenylchloroborane is calculated, from observations upon three different parameters characterizing the shape of the NMR signal, as 14 $\pm$0.8 kcal $mole^{-1}$. The barrier in the corresponding bromocompound was evaluated as 21 $\pm$0.7 kcal $mole^{-1}$ by analogous methods. The interesting features of the NMR spectrum of the recently reported compound, 1,3-di-t-butyl-2,4-di-t-butylamino-1,3-diaza-2,4-boretane, which clearly demonstrate that the compound has more than one steric configuration presumably due to exocyclic π-bonding, are also presented. Author

N65-10611# Bureau of Mines, Albany, Ore. Albany Metallurgy Research Center
ELECTRON-BEAM PURIFICATION OF HAFNIUM
Wallace E. Anable and R. A. Beall 1964 35 p refs
(Contract AT(11-1)-599)
(BM-RI-6560)

The purification of hafnium by electron-beam melting at moderate energy inputs and at low pressures was examined in detail. Most metallic impurities and hydrogen were removed in the first few minutes of operation; oxygen, carbon, and nitrogen were removed at a slower rate. Samples treated by electron bombardment suffered a small loss of weight and a gradual lowering of hardness. The magnitude of each change varied with the energy input and the duration of the melt. Analysis of the data confirms the loss of oxygen as a hafnium monoxide. Approximate activity coefficients for other contaminants are given. Author

N65-10643# Tyco Labs., Inc., Waltham, Mass.
ELECTROCHEMISTRY OF FUEL CELL ELECTRODES Technical Memorandum
Aug. 1964 36 p refs
(Contract Nonr-3765(00); ARPA Order 302-62)
(TM-14; AD-446423)

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1. GALVANOSTATIC STUDIES OF CARBON MONOXIDE ADSORPTION ON PLATINUM ELECTRODES S. B. Brummer and J. I. Ford p 1–25 refs (See N65-10644 01-06)
2. COMPARISON OF ADSORBED FORMIC ACID AND CARBON MONOXIDE ON PLATINUM ELECTRODES S. B. Brummer p 26–33 refs (See N65-10645 01-06)

N65-10644 Tyco Labs., Inc., Waltham, Mass.
GALVANOSTATIC STUDIES OF CARBON MONOXIDE ADSORPTION ON PLATINUM ELECTRODES
S. S. Brummer and J. I. Ford *In its* Electrochem. of Fuel Cell Electrodes Aug. 1964 p 1–25 refs (See N65-10643 01-06)

The adsorption of CO on smooth Pt from solutions of 1-N $HClO_4$ saturated with 1 atm of CO at 40°C has been studied, using anodic and cathodic galvanostatic transients. It is found that when a large anodic current, i_a, is applied to the electrode, the potential increases rapidly to $\sim$ 1.2 V (vs H_2/H^+ in the same solution), falls to $\sim$ 1.0 V, slowly starts to increase again, and finally becomes almost steady, probably due to O_2 evolution. The charge passed in the various regions of this transient is insensitive to the current density in the range 2.3 to 147 ma/cm^2 and, also, to the starting potential in the range 0.1 to 0.8 V. During the application of such a current, three processes contribute to the charge passed, Q_a. These are oxidation of adsorbate, oxidation of a species in solution, and surface oxidation of the electrode. Author

N65-10645# Tyco Labs., Inc., Waltham, Mass.
COMPARISON OF ADSORBED FORMIC ACID AND CARBON MONOXIDE ON PLATINUM ELECTRODES
S. B. Brummer *In its* Electrochem. of Fuel Cell Electrodes Aug. 1964 p 26–33 refs (See N65-10643 01-06)

The low potential anodic oxidation of HCOOH on Pt is poisoned by the slow adsorption of an interfering species on the electrode. It has been suggested that this species is CO formed by decomposition of the HCOOH. A comparison is made between the properties of the adsorbed films formed on Pt in HCOOH and CO-saturated solutions. Both the coulometric behavior and the oxidation kinetics of the adsorbed films suggest that they are not the same. Author

N65-10649# Southwest Research Inst., San Antonio, Tex.
A BASIC STUDY OF THE SOLUBILITY OF SOLIDS IN GASES AT HIGH PRESSURES Final Report, Jul. 7, 1963–Jul. 6, 1964
Judith Eisenbeiss 6 Aug. 1964 40 p refs
(Contract DA-18-108-AMC-244(A))
(AD-604345)

The solubility of phenanthrene in gaseous ethylene, ethane, methane, carbon dioxide, and carbon tetrafluoride in the pressure range of 2000 to 8000 psi at 40°C has been determined experimentally. It has been found that the solubility as a function of pressure changes nonlinearly for C_2H_4, C_2H_6, and CO_2, the incremental solubility decreasing with increasing pressure. The dissolving power of the various gases tends to be in the following order: $C_2H_4 > C_2H_6 > CO_2 > CH_4 > CF_4$. A static equilibrium arrangement was used. The saturated gaseous phase was analyzed for its content of phenanthrene by decompressing from equilibrium pressure, capturing the precipitated solid by a condensation trap, measuring the expanded gas volume at atmospheric pressure and room temperature, and weighing the precipitated solid directly. Mercury served as the compressing fluid; its solubility in the gases was considered to be negligible under the conditions of the experiments. Author

N65-10662# Pennsylvania U., Philadelphia Electrochemistry Lab.
REVERSIBLE OXYGEN ELECTRODES Tenth Quarterly Report, 1 Apr.–30 Jun. 1964
M. Genshaw, V. Brusic, and A. Damjanovic [1964] 28 p refs
(Contract DA-36-039-SC-88921)
(Rept.-10; AD-449408)

Some possible mechanisms of oxygen dissolution are reviewed. The role of a rotating-disk electrode, with a ring for discriminating between various possible mechanisms, is illustrated. In the study of the catalytic activity for the reduction of oxygen, Tafel lines on Pt, Pd, Rh, Ir, and Au electrodes and on a number of Au-Pd and Au-Pt alloy electrodes have been obtained in both acid and alkaline media. At zero current density, the rest potentials correspond to those established on oxide-free electrodes in oxygenated solutions. Platinum, palladium, platinum rich Pt-Au, and palladium rich Pd-Au alloy electrodes showed, in acid solutions, Tafel slopes close to RT/F, but on gold and gold rich Pt-Au and Pd-Au alloy electrode, the slope is close to 2RT/F. It appears that the change of slope from RT/F to 2RT/F, and also the change in the activity of electrodes, occur at alloy compositions at which no dissociative adsorption of oxygen is expected. In alkaline solutions, Tafel slopes do not change with alloying, but there is a change in the activity of electrode occurring at the same alloy composition.
Author

N65-10664# Rohm and Haas Co., Huntsville, Ala. Redstone Arsenal Research Div.
APPLICATIONS OF FLOW REACTOR MODELS TO PROCESS SIMULATION
Donald A. Willoughby and Thomas J. Dwyer 9 Oct. 1964 29 p refs
(Contract DA-01-021-ORD-11878(Z))
(S-54; AD-450051)

A tubular flow reactor, operating in laminar flow, is used to synthesize a product by a highly exothermic liquid-phase reaction. Three mathematical models of the reactor are described and solved, and the solutions are compared. The most sophisticated model includes the coupled effects of heat conduction, mass diffusion, and the exothermic chemical reaction. A listing of the FORTRAN IV IBM-7094 computer program used in solving this model is included.
Author

N65-10744# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CRYSTALLOPTICAL AND THERMOGRAPHIC ANALYSES OF DEPOSITS OBTAINED IN THE PROCESSING OF NEPHELINIC ORE OBTAINED BY A HYDROCHEMICAL METHOD
M. N. Kazov, Z. T. Fateyev, V. D. Ponomarev, S. F. Akhmetov, and Kh. N. Nurmagambetov *In its* Nonferrous Met. 29 Jun. 1964 p 116–124 refs (See N65-10737 01-17)

Investigation of the various technological operations in the hydrochemical method of processing nephelinic ores has established that the structure of the deposits after leaching has a substantial effect on the results of subsequent operations. In order to elucidate the structure of these deposits, crystalloptical and thermographic methods were used. The results of the study indicated that the structures of sodium–calcium hydrosilicate varies as a function of length of preparation, and that to increase the activity of the compound, the process must be conducted under conditions favoring minimal contact with the atmospheric carbon dioxide.
P.V.E.

N65-10748# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ADSORPTION OF GASES ON URANIUM MIXED OXIDES
V. G. Vlasov, V. M. Zhukovskiy, A. G. Lebedev, and V. N. Shalaginov *In its* Nonferrous Met. 29 Jun. 1964 p 152–158 refs (See N65-10737 01-17)

Adsorbability of hydrogen, carbon monoxide, ammonia, nitrogen, carbon dioxide, and water vapor on uranium mixed oxide is studied at elevated temperatures. A correlation is established between the data of adsorbability of gases and the results of studies made of the kinetics of uranium-mixed-oxide reduction by hydrogen, a nitrogen–hydrogen mixture, ammonia, and carbon monoxide.
Author

N65-10749# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ELECTROCONDUCTIVITY IN THE UO_3-C SYSTEM
Ye. V. Tkachenko, A. D. Neuymin, V. G. Valasov, and V. N. Strekalovskiy *In its* Nonferrous Met. 29 Jun. 1964 p 159–165 refs (See N65-10737 01-17)

The method of measuring electrical conductivity, which is simple and under certain conditions convenient, has been used to corroborate the boundary limit to the existence of a uranium-trioxide-based solid solution, determined earlier by kinetic and X-ray methods, and also has shown that the rate of the overall process can be characterized by the rate of change in electrical conductivity. With the aid of this method it has been possible to obtain data affording ideas on the role of dissociation in the reduction process.
Author

N65-10774*# Stanford Research Inst., Menlo Park, Calif.
EVALUATION OF INFRARED SPECTROPHOTOMETRY FOR COMPOSITIONAL ANALYSIS OF LUNAR AND PLANETARY SOILS. PART II: ROUGH AND POWDERED SURFACES
R. J. P. Lyon Washington, NASA, Nov. 1964 278 p refs
(Contract NASr-49(04))
(NASA-CR-100) OTS Prices: HC $4.00/MF $1.25

This is a study of the normal emittance, reflectance, and transmittance spectra of roughened and powdered rock and mineral surfaces from 8μ to 25μ wavelength. Tektites and chondrites showed a 2.0μ displacement in the wavelength of their spectral peaks. The definition of rock compositions, by either reflectance or emittance techniques, decreased in proportion to their particle size, and only materials with marked special contrast are distinguishable near the 50μ particle size. The frustrated multiple internal reflectance (FMIR) technique seems to be feasible in the compositional analysis of silicate powders in the 1 to 40 size range. The emittance and reflectance processes of rocks and minerals were found to be determined to a large extent by the "surface skin" on each grain.
G.G.

N65-10795# Chicago U., Ill.
THE METASTABILITY OF AMORPHOUS STRUCTURES
Morrel H. Cohen and David Turnbull (Harvard U.) 7 Aug. 1964 5 p refs
(Contract Nonr-2121(22))
(AD-604355)

Two instances of metastability for a monatomic system are presented. One describes the random arrangement of hard spheres compressed to a rigid and apparently amorphous structure with a unique density; the other pertains to calculations of the trajectories of a collection of spherical atoms interacting via a 6 to 12 potential appropriate to argon, and held at a density equivalent to that of crystalline argon at 40° K and 1 atm pressure.
G.G.

N65-10796# Naples U. (Italy) Lab. of Molecular Spectroscopy
[MOLECULAR VIBRATIONS STUDIES] Final Technical Report, 1 Apr. 1963–30 Apr. 1964
Salvatore Califano et al [1964] 105 p
(Contract DA-91-591-EUC-2865)
(AD-446281)

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3. THE INFRARED SPECTRUM IN POLARIZED LIGHT OF TRANS-TRANS-TRANS CYCLODODECATRIENE F. Ambrosino, N. Neto, and S. Califano p 45–59 refs
4. THE UREY-BRADLEY AND THE VALENCE FORCE FIELD OF PYRAZINE M. Scrocco, C. Di Lauro, and S. Califano p 60–73 refs
5. THE VIBRATIONAL SPECTRUM OF PERYLENE F. Ambrosino and S. Califano p 74–85 refs
6. THE VIBRATIONAL SPECTRA OF ANHYDRIDES. 1: CRYSTAL SPECTRUM AND FORCE CONSTANTS OF MALEIC ANHYDRIDE C. Di Lauro and S. Califano p 86–97 refs
7. VALENCE FORCE FIELD OF AROMATIC MOLECULES N. Neto, M. Scrocco, and S. Califano p 98–102

N65-10807# Dewey (G.C.) Corp., New York, N.Y.
AN EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF RADIATION OF THE PROPAGATION OF ELECTROMAGNETIC SIGNALS IN AIR Third Quarterly Progress Report, 1 Jan.–31 Mar. 1964
M. N. Hirsh and P. N. Eisner 31 Mar. 1964 25 p refs
(Contract DA-36-039-AMC-03278(E))
(R-173-3; AD-603770)

This study pertains to mass-spectrometer measurements of some irradiated gases. The identification of O_4^+ as the dominant positive ion in O_2, and in 2:1 N_2-O_2 mixtures at pressures between 1 and 10 torr was made. A series of steady-state measurements of electron densities as a function of pressure and the beam current were performed on O_2 and on various mixtures of N_2 and O_2. It was observed that the greater degree of the N_2 concentration in the gas mixture was concurrent with the higher pressure at which the peak of the ionization occurs, but the peak of the oxygen curve seems to be reached at lower pressures. G.G.

N65-10838*# Stanford Research Inst., Menlo Park, Calif.
MAGNETIC PROPERTIES OF SOME MACROMOLECULES OF BIOLOGICAL INTEREST Progress Report No. 4, May–Jul. 1964
Bascom S. Deaver, Jr. 14 Oct. 1964 10 p refs
(Contract NASr-49(16); SRI Proj. 4644)
(NASA-CR-59506) OTS Prices: HC $1.00/MF $0.50

This paper describes the design and development of an apparatus employing a superconducting circuit that is capable of detecting very small changes in the magnetic flux, for use in measuring the magnetic susceptibility of macromolecules. The apparatus was calibrated with a superconducting lead rod, and measurements were made on two samples of coronene ($C_{24}H_{12}$). A very anisotropic magnetic susceptibility at 20° K was observed and was attributed to the ring structure of the coronene. G.G.

N65-10855# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
CARBURIZATION AND CHEMICAL TREATMENTS FOR RECOVERY OF URANIUM FROM STAINLESS STEEL FUEL ELEMENTS
R. E. Adams and E. S. Bomar, Jr. Nov. 1964 57 p refs
(Contract W-7405-ENG-26)
(ORNL-2398) OTS: $3.00

Two promising metallurgical treatments to simplify reprocessing of spent stainless-steel fuel elements have been demonstrated on the plate-type fuel elements developed for the Army Package Power Reactor, in which uranium dioxide is dispersed in a matrix of stainless steel. These processes are described, and the advantages common to both are discussed and include the following: (1) The chemical solutions used are essentially inert to stainless steel so that conventional dissolvers and piping may used. (2) The unburned uranium is recovered in nitric acid solutions that are compatible with existing processes and equipment for uranium purification. (3) The radioactive waste volumes are decreased because 20% to 80% of the stainless steel is left for storage as chemically inert solids, and the uranium is dissolved in a relatively small volume. M.P.G.

N65-10859# Joint Publications Research Service, Washington, D.C.
CHEMISTRY OF PEROXIDE COMPOUNDS
I. I. Chernyayev and T. A. Dobrynina, ed. 20 Nov. 1964 471 p refs Transl. into ENGLISH of the monograph "Khimiya Peroksidnykh Soyedineniy" Moscow, Publishing House of the Acad. of Sci. of the USSR, 1963 p 1–313 Papers presented at the 2d Conf. on the Chem. of Peroxide Compounds, Moscow, 14–18 Nov. 1961
(JPRS-27465; TT-64-51714) OTS: $7.70

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N65-10890# Baylor U., Waco, Tex.
AN INVESTIGATION OF THE MECHANISM OF ELECTROLYTIC OXIDATION OF ORGANIC COMPOUNDS AND OF COMPETITIVE PROCESSES INVOLVING HYDROGEN AT THE SURFACE OF THE SOLID METAL ELECTRODES Final Report
Thomas C. Franklin, Nellie F. Franklin, Charles Liang, Fujio Matsuda, Donald Mc Clelland et al Bedford, Mass., AFCRL, Jun. 1964 99 p refs
(Contract AF 19(604)-8414)
(AFCRL-64-517; AD-605809)

Low-molecular-weight organic compounds underwent electrolytic oxidation by the application of cyclic voltametry, chronopotentiometry, potential decay, and potential oxidation at platinum electrodes. The electrolytic oxidation of the investigated compounds was of a chemical nature. The decomposition of hydrogen peroxide and of formaldehyde, as well as the oxidation of methanol, occurred on the more energetic adsoprtion site of the platinum electrodes; the formaldehyde oxidation occurred at the less energetic adsorption site; and the catalytic hydrogenation of quinone took place at both sites of the platinum electrodes. The presence of hydrogen on the electrode causes a decrease in the capacitance proportional to the amount of hydrogen on the electrode. G.G.

N65-10943# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NEWS IN REGIONS OF ELECTROCHEMICAL SYNTHESIS OF OXIDIZERS
V. G. Khomyakov and M. Ya. Fioshin 11 May 1964 24 p refs Transl. into ENGLISH from Khim. Prom. (Leningrad), No. 1, 1962
(FTD-MT-64-183; AD-602572)

Various methods of electrosynthesis of oxidizers are discussed, improvements in flow charts are presented, and intensifications of electrolytic processes are described. The following chemicals were investigated: "Oxygen Compounds of Chlorine"; "Persulfuric Acid and Persulfate of Ammonium"; "Oxygen Compounds of Manganese"; "Bichromates"; "Bromates, Iodates, and Iodic Acid"; and "Perborate, Percarbonates, Tetra Acetate of Lead." G.G.

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N65-10100 Joint Publications Research Service, Washington, D.C.
SCATTERING OF WAVES UNDER CONDITIONS OF TOTAL REFLECTION
N. G. Denisov *In its* Izv. VUZov: Radiophys., no. 2, 1964 19 Oct. 1964 p 263-266 refs (See N65-10076 01-29) OTS: $6.00

In order to understand the nature of the scattering of standing waves on space inhomogeneities, the simplest case is considered for this problem—plane waves scattered at normal incidence on a reflecting surface defining the boundary of a plane layer filled with random inhomogeneities. Formulas for the angular power spectrum and for the angular spectrum for the scattering field power are derived. The formula for the angular power spectrum is said to coincide, to within a constant factor, with the fluctuation spectrum for the phase of a wave traversing an inhomogeneous layer. D.E.W.

N65-10104# Raytheon Co., Santa Barbara, Calif. Space and Information Systems Div.
FEASIBILITY STUDY OF ANTENNA TECHNIQUES INCORPORATING UNIDIRECTIONAL DEVICES AS FUNCTIONAL ELEMENTS Interim Engineering Report, 15 Jun.–30 Sep. 1964
M. J. Bock and G. E. Malby Wright-Patterson AFB, Ohio, Res. and Technol. Div., 30 Sep. 1964 92 p refs
(Contract AF 33(615)-1256)
(IER-2; AD-448498)

An analysis and experimental verification has established the feasibility of integrating a nonlinear, unidirectional current device into a conductor to form a controlled unified radiating element. The concept has been extended to include the analysis and investigation of a multipolarization mixer. Author

N65-10106*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
SPACE PROGRAMS SUMMARY NO. 37-29, VOLUME III FOR THE PERIOD JULY 1, 1964 TO AUGUST 31, 1964. DEEP SPACE NETWORK
30 Sep. 1964 116 p refs
(Contract NAS7-100)
(NASA-CR-59413; JPL-SPS-37-29, Vol. III) OTS Prices: HC $4.00/MF $1.00

The status of Deep Space Network (DSN) projects is summarized in the following areas: tracking-station engineering and operations, space-flight operations facility, communications engineering developments, communications research and development, and advanced antenna systems. M.P.G.

N65-10200# California U., Berkeley Electronics Research Lab.
SYNTHESIS OF DUAL REFLECTOR ANTENNAS
Victor Galindo 30 Jul. 1964 281 p refs *Its* Rept.-64-22
(Grants AF-AFOSR-139-63; AF-AFOSR-139-64)
(AFOSR-64-1583; AD-445821)

A synthesis method based on geometrical optics for designing a dual reflector antenna system with an arbitrary phase and amplitude distribution in the aperture of the second reflector is presented. The first reflector may be illuminated by a pattern with an arbitrarily curved phase front. A pair of first-order, ordinary, nonlinear differential equations of the form $dy/dx = f(x,y)$ are developed for the system. Questions concerning uniqueness, existence, and bounds for the solutions are discussed. Calculations and numerical results for the design of a uniform amplitude and phase dual-reflector system are presented. The diffraction effects of the small reflector are analyzed by the methods of geometrical diffraction. Their effects upon the aperture distribution of the larger reflector are analyzed in detail. Author

N65-10205# Admiralty Research Lab., Teddington (Gt. Brit.)
THE HETERODYNING OF CLIPPED FUNCTIONS–II
E. M. Wilson Jun. 1964 11 p ref
(ARL/M/R10, R4/2-77; AD-445163)

A process is described for obtaining the zeros of a heterodyned version of an arbitrary square-wave signal of constant amplitude, whose zeros are given, and in which the rectangular elements of the initial signal are replaced by parabolic arcs. G.G.

N65-10225# Air Proving Ground Center, Eglin AFB, Fla.
ATMOSPHERIC REFRACTION EFFECTS ON TRACKING SYSTEM DATA
Preston M. Landry and Larry D. Parks Sep. 1963 41 p refs Presented at an APGC Tech. Seminar, Jun. 1963
(APGC-TDR-63-28; AD-417510)

A discussion is given of the refractive effects of the atmosphere on the data obtained from tracking devices. Causes of difficulties in making refraction corrections are given with some suggestions for minimizing errors. A mathematical derivation of the correction equations is given, and numerical techniques are indicated for evaluating the correction equations. Author

N65-10240# Goodyear Aerospace Corp., Akron, Ohio
STUDY, FABRICATION, AND TESTING OF PASSIVE SATELLITE MODELS, GRID-SPHERE TYPE Technical Documentary Report, May 1963–May 1964
Wright-Patterson AFB, Ohio, Systems Eng. Group, Aug. 1964 127 p refs
(Contract AF 33(657)-11537)
(GER-11568; SEG-TDR-64-52; AD-607273)

The approximate vector potential solution for thin dielectric shells modified for a complex dielectric constant served as the theoretical approach. A computer solved the equations, and the results showed strong reflection at certain frequencies. The empirical investigation covered impedance measurements of flat grid panels, and backscattering tests of a 20-inch and an inflatable 14-ft grid sphere. The tests confirmed enhanced reflectivity, but did not fully agree with the theory. Scintillations showed up in all cases whereby a trend toward decreasing scintillations for increasing backscattering could be observed. True behavior of a grid sphere can only be obtained empirically by tests, or theoretically by the induced currents method. Author

N65-10262# Rome Air Development Center, Griffiss AFB, N.Y. Research and Technology Div.
INVESTIGATION OF TUNNEL DIODE AMPLIFIERS AS A PSEUDO PASSIVE UNIT
Dean L. Baerwald and Anthony F. Snyder Sep. 1964 36 p refs
(RADC-TDR-64-340; AD-607475)

This report covers the integration of a strip-line tunnel diode reflection amplifier and spiral antenna. The characteristics of the individual amplifiers, such as gain, bandwidth, saturation limits, and physical construction, are included. Theoretical and experimental characteristics of a three-element pseudopassive array are also given. Criteria for construction of a pseudopassive unit are developed. Author

N65-10289# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE INADEQUACY OF THE INTEGRAL ANTENNA EQUATION
I. G. Klyatskin 23 Sep. 1964 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 152, no. 5, 1963 p 1089–1091
(FTD-TT-64-673/1; AD-607300)

This derivation of the integral antenna equation, together with the determination of the vector potential, considers not only the field of the currents but also the field of the excitation device, and develops the real integral equation of the transmitting antenna. G.G.

N65-10364# Joint Publications Research Service, Washington, D.C.
INCREASING THE NOISE STABILITY OF PULSE-WIDTH AND PULSE-TIME MODULATED TELEMETERING BY MEANS OF A TIME SELECTOR
N. V. Pozin 17 Nov. 1964 14 p refs Transl. into ENGLISH from Avtomat. i Telemekh. (Moscow), v. 25, no. 4, Apr. 1964 p 539–546
(JPRS-27397; TT-64-51653) OTS: $1.00

As a supplement to N. V. Pozin's earlier work on the noise stability of pulse-width and pulse-time modulated telemetering during strong fluctuating noises, the noise stability of telemetering with pulse-width and pulse-time modulation is analyzed for the case where distortions, introduced by the noises, bear the character of false pulses and breaks. The role of a time selector that removes some of these distortions is evaluated. The optimal time selection is made. Author

N65-10429# National Research Council of Canada, Ottawa Radio and Electrical Engineering Div.
BULLETIN OF THE RADIO AND ELECTRICAL ENGINEERING DIVISION, NATIONAL RESEARCH COUNCIL OF CANADA, VOL. 14, NO. 2, APRIL–JUNE 1964
Jun. 1964 64 p refs

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N65-10432 Air Technology Corp., Cambridge, Mass.
LOW FREQUENCY AIRBORNE ANTENNA SYSTEM Monthly Report, 1–30 Jun. 1964
James C. Maxwell 30 Jun. 1964 10 p
(Contract DA-02-086-AMC-0051(E))
(AD-449755)

Several loop and whip low-frequency omnidirectional antennas were investigated for their suitability in a low-frequency airborne antenna system. It was found that the loop antenna cannot be used in a phase-comparison navigation system, because this type of antenna introduces a phase shift to the bearing angle of the incoming signal. A 2-foot whip-antenna design with a high-point-impedance preamplifier located in the base of the whip was initiated for future use in both navigation and communications systems. The tailcap antenna, the trailing- or fixed-wire antenna, and the slot-antenna system were found to be less desirable. G.G.

N65-10483# Sylvania Electric Products, Inc., Williamsville, N.Y.
ELECTRONICALLY STEERABLE ARRAY FOR SPACE VEHICLE APPLICATION Final Report
T. R. Schiller Griffiss AFB, N.Y., RADC, Aug. 1964 188 p refs
(Contract AF 30(602)-3041)
(RADC-TDR-222; AD-607439)

The purpose of this investigation was to determine the feasibility of designing and constructing a high gain, broadband, inertialess scanned antenna at millimeter frequencies (30 to 100 Gc) for aerospace applications. Quasi-optical ferromagnetic beam scanning was studied analytically and experimentally. Quasi-optical diffraction grating techniques, where both the spacing between grating elements and the distance (depth) between grating elements can be used to realize scanning, were also studied analytically. A third technique was studied, in which a small aperture ferromagnetic scanner (aperture less than 6λ) is used with scattering and spherical optics. Detailed descriptions are presented of the antenna systems using either cubic lattice ferrites or hexagonal lattice ferrites. In addition, the technique employing ferromagnetic materials as scattering mechanism spherical optics is detailed. Author

N65-10488# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE OPTIMUM FILTERS FOR THE DETECTION OF COHERENT SIGNALS IN CORRELATED NOISE
J. Kroszczynski 9 Oct. 1964 15 p refs Transl. into ENGLISH from Prace, Przemyslowy Inst. Telekomunikacji, (Poland), v. 13, no. 30, 1963 p 1–8
(FTD-TT-64-622/1+2; AD-607499)

Discussed were characteristics of filters appearing in systems realizing optimum reception in the presence of correlated and noncorrelated noises. Established was the dependence describing the circumference of maxima of characteristics of narrowband filters at multichannel reception systems for the case of a great number of channels. Outlines were given, representing the form of the mentioned circumference in relation to the width of the band of correlated noise. Author

N65-10534# Joint Publications Research Service, Washington, D.C.
RADIO COMMUNICATION AND SATELLITES

In its Transl. on Communist China's Sci. and Technol., No. 120 5 Nov. 1964 p 54–56 (See N65-10533 01-08) OTS: $4.00

A general discussion of the problems encountered in using vhf and microwave frequencies for communication networks is presented. The feasibility and advantages of using "stationary" satellites for relay stations are outlined. P.V.E.

N65-10701# Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J. Solid State and Frequency Control Div.
PROCEEDINGS OF THE 17TH ANNUAL SYMPOSIUM ON FREQUENCY CONTROL
[1963] 626 p refs Symp. held at Atlantic City, 27–29 May 1963
(AD-423381)

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1. STUDIES ON HIGH PRECISION RESONATORS R. A. Sykes, W. L. Smith, and W. J. Spencer (Bell Telephone Labs.) p 4–27 refs (See N65-10702 01-09)

2. MEASUREMENT OF AMPLITUDE DISTRIBUTION OF VIBRATING AT-CUT CRYSTALS BY MEANS OF OPTICAL OBSERVATIONS G. Sauerbrey (Technische U., Berlin) p 28–50 refs (See N65-10703 01-26)

3. REACTIONS OF A VIBRATING PIEZOELECTRIC CRYSTAL PLATE TO EXTERNALLY APPLIED FORCES C. R. Mingins, L. C. Barcus, and R. W. Perry (Lowell Technol. Inst. Res. Found.) p 51–87 refs (See N65-10704 01-26)

4. ENERGY TRAPPING AND RELATED STUDIES OF MULTIPLE ELECTRODE FILTER CYSTALS W. Shockley, D. R. Curran, and D. J. Koneval (Clevite Corp.) p 88–126 refs (See N65-10705 01-26)

5. AGING CHARACTERISTICS OF QUARTZ RESONATORS WITH COMMENTS ON THE EFFECTS OF RADIATION R. B. Belser and W. H. Hicklin (Ga. Inst. of Tech.) p 127–175 refs (See N65-10706 01-09)

6. APPLICATION OF SUPERCONDUCTIVITY TO FREQUENCY CONTROL W. H. Hartwig (Tex. U.) p 176–189 refs (See N65-10707 01-26)

7. STATUS OF QUARTZ CRYSTAL RESEARCH AND DEVELOPMENT G. K. Guttwein p 190–214 refs (See N65-10708 01-26)

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8. PRECISION CRYSTAL UNITS D. Hammond, C. Adams, and L. Cutler (Hewlett-Packard Co.) p 215–232 refs (See N65-10709 01-26)

9. HIGH Q CRYSTAL UNITS W. Ianouchevsky (Paris Obs.) p 233–247 refs (See N65-10710 01-26)

10. USE OF PARALLEL-FIELD EXCITATION IN THE DESIGN OF QUARTZ CRYSTAL UNITS A. W. Warner (Bell Telephone Labs.) p 248–266 refs (See N65-10711 01-26)

11. CRYSTAL UNITS FOR SINGLE SIDEBAND APPLICATION P. Bryan and E. M. Shideler (Sci. Electron. Products, Inc.) p 267–271 (See N65-10712 01-09)

12. DESIGN EQUATIONS FOR PLANO-CONVEX AT FILTER CRYSTALS W. G. Stoddard (Gen. Elec. Co.) p 272–282 refs (See N65-10713 01-26)

13. DEVELOPMENT STATUS OF QUARTZ MICROMODULE CRYSTAL UNITS P. J. Staelens (Midland Mfg. Co.) p 283–288 (See N65-10714 01-09)

14. RELIABILITY OF MILITARY QUARTZ CRYSTAL UNITS W. G. Ingling and C. E. Jones (Inland Testing Labs.) p 289–301 refs (See N65-10715 01-15)

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15. IMPROVEMENTS IN TECHNIQUE FOR THERMOCOMPRESSING MOUNTING WIRES TO QUARTZ CRYSTAL PLATES J. P. Griffin (Bell Telephone Labs.) p 302–311 (See N65-10716 01-15)

16. SPURIOUS MODES IN AT-CUT QUARTZ CRYSTALS A. E. Anderson (Collins Radio Co.) p 312–313 (See N65-10717 01-26)

17. TEMPERATURE TESTING TIGHT TOLERANCE CRYSTAL UNITS G. Bistline, Jr. (McCoy Electron. Co.) p 314–315 (See N65-10718 01-15)

18. THE HYBRID-COIL BRIDGE METHOD OF MEASURING UNWANTED MODES OF VIBRATION IN QUARTZ CRYSTALS W. H. Horton and R. C. Smythe (Systems Inc.) p 316–324 refs (See N65-10719 01-15)

19. PROBLEMS ASSOCIATED WITH PRECISION QUARTZ RESONATORS W. J. Spencer (Bell Telephone Labs.) p 325–328 refs (See N65-10720 01-09)

ATOMIC AND MOLECULAR FREQUENCY CONTROL

20. ACHIEVEMENTS AND PROBLEM AREAS OF ATOMIC FREQUENCY CONTROL F. H. Reder p 329–371 refs (See N65-10721 01-15)

21. FREQUENCY BEAT EXPERIMENTS WITH HYDROGEN MASERS R. F. C. Vessot and H. E. Peters (Varian Associates) p 372–391 refs (See N65-10722 01-16)

22. EXPERIMENTAL EVALUATION OF A THALLIUM BEAM FREQUENCY STANDARD R. E. Beehler and D. J. Glaze (Natl. Bur. of Standards) p 392–407 refs (See N65-10723 01-14)

23. RECENT DEVELOPMENTS IN THE FIELD OF ATOMIC FREQUENCY AND TIME STANDARDS IN SWITZERLAND J. Bonanomi (Observatoire, Neuchatel, Switzerland) p 408

24. EXCITATION OF MILLIMETER WAVE TRANSITIONS FOR FREQUENCY CONTROL R. G. Strauch, R. E. Cupp, and J. J. Gallagher (Martin Co.) p 409–424 refs (See N65-10724 01-26)

25. FREQUENCY STANDARDS IN THE OPTICAL RANGE G. Gould (TRG, Inc.) p 425–437 refs (See N65-10725 01-16)

26. THE DEVELOPMENT AND PERFORMANCE OF A MINIATURIZED CESIUM BEAM TUBE J. George (Natl. Co., Inc.) p 438–448 (See N65-10726 01-09)

27. PERFORMANCE AND APPLICATION OF GAS CELL FREQUENCY STANDARDS D. J. Farmer (Gen. Tech. Corp.) p 449–461 refs (See N65-10727 01-09)

28. REPORT ON THE FREQUENCY OF HYDROGEN W. Markowitz (U.S. Naval Obs.) p 462–463 (See N65-10728 01-16)

CIRCUITS AND MEASUREMENTS

29. PROGRESS AND PROBLEMS IN QUARTZ CRYSTAL CIRCUITRY AND MEASUREMENTS O. P. Layden p 464–481 refs (See N65-10729 01-10)

30. PROBLEMS OF FREQUENCY MULTIPLICATION IN ATOMIC STANDARDS H. D. Guy (Natl. Co., Inc.) p 482–490 (See N65-10730 01-10)

31. TEMPERATURE COMPENSATION OF QUARTZ CRYSTAL OSCILLATORS D. E. Newell and R. H. Bangert (Bendix Corp.) p 491–507 (See N65-10731 01-09)

32. THEORY OF OSCILLATOR DESIGN E. Hafner p 508–536 refs (See N65-10732 01-10)

33. ACCURACY OF VHF FILTER CRYSTAL MEASUREMENTS A. D. Ballato and F. K. Priebe p 537–565 refs (See N65-10733 01-09)

34. RECENT DEVELOPMENTS IN CRYSTAL FILTERS D. I. Kosowsky and C. R. Hurtig (Damon Eng., Inc.) p 566–586 refs (See N65-10734 01-09)

35. FREQUENCY SYNTHESIZING TECHNIQUES PERMITTING DIRECT CONTROL AND RAPID SWITCHING R. R. Stone, Jr. and H. F. Hastings (NRL) p 587–601 (See N65-10735 01-09)

36. MEASUREMENT OF THE INSTANTANEOUS FREQUENCY AND PHASE STABILITY OF FREQUENCY STANDARDS BY MEANS OF FREQUENCY COMPARATORS B. Parzen (Parzen Res., Inc.) p 602–618 ref (See N65-10736 01-09)

N65-10792# Columbia U., Dobbs Ferry, N.Y. Hudson Labs.
MEASUREMENTS OF SOUND VELOCITY MADE WHILE ANCHORED IN THE VIRGIN ISLANDS BASIN Technical Report No. 107
Albert N. Guthrie and John D. Shaffer 18 Sep. 1963 18 p
(Contract Nonr-266(84))
(CU-128-63-ONR-266-Phys; AD-429772)

An NBS velocimeter was used to obtain measurements of the fluctuations in the velocity of sound at three shallow depths in the Virgin Islands Basin. The instrument was suspended from an anchored ship. During one run a simultaneous measurement was made with a resonant-cavity meter. The observed fluctuations are characterized in terms of the coefficient of variation and the autocorrelation function. The method of analysis was designed to reduce the effects of instrument motion upon the result. Author

N65-10812# Texas U., Austin Electrical Engineering Research Lab.
A MILLIMETER WAVELENGTH FREQUENCY STANDARD
H. D. Holden 10 Aug. 1964 42 p refs
(Contract AF 33(657)-8716)
(TR-8; AD-604896)

This report describes the development of a millimeter wavelength frequency standard. A very stable one-gigacycle signal, generated by a crystal controlled oscillator, is harmonically multiplied in two stages resulting in a very stable signal in the 50- to 60-gigacycle frequency range. The first section includes an introduction to radio spectroscopy, the field of investigation in which the frequency standard can be most effectively used. In the second section, theoretical aspects of harmonic generation are considered. The third and final section is a description of the frequency standard and an account of the investigations leading to its completion. Author

N65-10815# Sperry Microwave Electronics Co., Clearwater, Fla.
ATCRBS SLS OMNI DIRECTIONAL ANTENNA PROTOTYPE MODELS I AND II Final Engineering Report
R. E. Strother 7 Apr. 1964 17 p
(Contract FA-WA-4656)
(SJM-6567)

This report covers the design and production of two prototype omnidirectional antennas for implementation of the 3-pulse sidelobe suppression technique with the ATCRBS ground station. The two types of antennas differ in that the mounting flange of Prototype Model I is located at the base for mounting atop a metallic mast, and the mounting flange for Prototype Model II is located at the top for suspension installation within a spherical radome, housing the ground radar equipment. Also, the phasing device in the feed line differs in the two types of antennas to provide the desired beam tilt. The antennas are series-fed colinear dipole arrays properly spaced and phased to produce a vertical pattern very nearly coincident with that of the beacon directional antenna. Author

N65-10891# Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
OPTIMUM DESIGN OF ELECTROSTATICALLY FOCUSED FLOATING-DRIFT-TUBE KLYSTRON
H. G. Kosmahl Apr. 1963 17 p refs
(USAELRDL-TR-2338; AD-424596)

The usefulness of the floating-drift-tube oscillator could be greatly increased as an efficient signal source of medium power at frequencies above 10 kMc, if purely electrostatic focusing were applied. This report describes a method of designing floating-drift-tube klystrons, using Pierce guns, with no magnetic focusing required. In order to increase the available electronic efficiency, depressed collectors in the form of an "inversed" Pierce gun may be applied. The design procedures are discussed and outlined. Author

N65-10900# Naval Ordnance Lab., White Oak, Md.
AIRBORNE SYSTEM FOR THE MEASUREMENT OF INFRARED MISSILE SPECTRA
J. M. Ellis, D. E. Matlack, H. A. Templin, and G. M. Black Sep. 1964 45 p refs
(NOLTR-64-56; AD-603541)

An airborne spectrometer and tracker system for quantitative spectral measurements of ballistic missile plumes in the wavelength region from 1.0μ to 5.0μ is described. Measurements are made at an altitude of about 40 000 ft. Eight spectra per second are recorded with a wavelength resolution of the order of 0.1μ. The system NEFD is about 3×10^{-10} and 4×10^{-12} W/cm^2 with a PbSe and InSb detector, respectively. Data are processed on an IBM-7090 computer and a Stromberg Carlson-4020 microfilm plotter. Sample plots of H_λ and $H_\lambda R^2$ are given. Author

N65-10922# General Electric Co., Ithaca, N.Y. Defense Electronics Div.
SATELLITE-TO-SATELLITE PROPAGATION EXPERIMENT PAYLOAD EQUIPMENT TEST DATA Special Project Report, 17 May–18 Jun. 1963
C. Andrews, J. A. Lash, G. Williammee, and R. H. Wood [1963] 62 p
(Contract AF 19(628)-466)
(AD-451214)

Test data tabulations are presented for the following main-satellite receiving-system component characteristics: (1) receiver gain; (2) AGC response characteristics of intermediate-frequency amplifier; (3) receiver image rejection; (4) signal and AGC characteristics; (5) delay time in payload receiver; (6) receiver video characteristics; (7) receiver programer peak-pulse detector; (8) shock tests on Agena receiver systems; (9) vibration tests of Agena receiver systems. For the ejected-satellite transmitting system, the following are included: (1) transmitter powers; (2) transmitter programer stability; (3) shock tests on Agena transmitter system; and (4) vibration tests of Agena transmitter system. D.S.G.

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N65-10015# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Labs.
MULTIPLE SHIFT REGISTER REALIZATIONS OF SEQUENTIAL MACHINES
A. J. Nichols, III (Ph.D. Thesis-Stanford U.) Oct. 1964 134 p refs
(Rept.-6-74-64-48)

This study is concerned with the problem of mechanizing synchronous sequential machines with shift registers. It is shown that any machine can be mechanized with shift registers. The determination of the least number of shift registers (K_{min}) required in a mechanization of a given machine is investigated. A 20-step algorithm, suitable for programing on a digital computer, is developed that starts with the state table of the given machine and yields mechanizations having the least possible number of shift registers. The algorithm is based on the fact that there is a one-to-one correspondence between shift registers and certain partitions of the set of states of the machine. Author

N65-10140# Joint Publications Research Service, Washington, D.C.
BINARY–DECIMAL TRANSFORMATION CONVERSIONS IN INTEGRAL ELECTRONIC DIGITAL COMPUTERS
F. Ya. Galkin and A. M. Kayumov *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 114–118 (See N65-10126 01-14) OTS: $6.00

Methods are proposed for the conversion of numbers from the binary system into the decimal system, and from decimal to binary in integral binary computers intended for performance of accounting operations. These conversion methods are similar to the operations of division and multiplication, and suggest circuit hardware that reduces sharply the conversion time. Author

N65-10141# Joint Publications Research Service, Washington, D.C.
A MODIFICATION OF THE DIVISION ALGORITHM FOR ELECTRONIC COMPUTERS
B. V. Vidin and Yu. V. Orfeyev *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 119–123 ref (See N65-10126 01-14) OTS: $6.00

A method is described for the organization of the division process to economize equipment in division mechanizations. The method proposed can be used to reduce equipment requirements in parallel-action computers. Author

N65-10220# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
STUDY TO DETERMINE THE APPLICABILITY OF THE SOLOMON COMPUTER TO COMMAND AND CONTROL. VOLUME IV: SUMMARY Final Report
Franklyn M. Rybak Bedford, Mass., AFSC, Electron. Systems Div., Oct. 1964 59 p
(Contract AF 19(628)-2846)
(ESD-TDR-64-184, Vol. IV; AD-450214)

Specific tasks pursued were an investigation into the benefits to be gained in information storage and retrieval systems through file maintenance and search with Solomon I; a consideration of the control of large communication networks through real-time simulation on Solomon I; and the study of control and processing functions in radar sensor subsystems, as well as in radar-oriented-weapons control systems. To illustrate the potential of parallel organized computers, especially Solomon I, in command and control systems, specific application examples are provided. Author

N65-10232# International Business Machines Corp., Owego, N.Y. Radiation Effects Dept.
AUTOMATED DIGITAL COMPUTER PROGRAM FOR DETERMINING RESPONSES OF ELECTRONIC SYSTEMS TO TRANSIENT NUCLEAR RADIATION. VOLUME III: TREAT COMPONENT ANALYSIS PROGRAM
Kirtland AFB, N. Mex., AF Weapons Lab., Aug. 1964 208 p refs
(Contract AF 29(601)-5399)
(WL-TDR-64-62, Vol. III; AD-607409)

The TREAT (Transient Radiation Effect Automated Tabulation) system of six independent, but complementary, digital computer programs has been developed to aid in the processing of data on transient and permanent effects of radiation on electronic components. Each program treats a particular aspect of the overall processing task. Given raw laboratory data recorded before and after irradiation, the system provides calculated device parameters for each sample and the radiation-induced change in these parameters. These data are combined with radiation environment information, also processed by the system, and applied to theoretical equations to predict the response or damage to device parameters during irradiation. Information on typical rather than specific devices and/or radiation environments is also available for typical response predictions. As many as 1000 samples each of transistors, diodes, and capacitors can be processed concurrently. This report contains a complete functional description of the system as well as all necessary operating instructions. Author

N65-10233# International Business Machines Corp., Oswego, N.Y. Radiation Effects Dept.
AUTOMATED DIGITAL COMPUTER PROGRAM FOR DETERMINING RESPONSES OF ELECTRONIC SYSTEMS TO TRANSIENT NUCLEAR RADIATION. VOLUME II: PREDICT CIRCUIT ANALYSIS PROGRAM
Kirtland AFB, N. Mex., AF Weapons Lab., Aug. 1964 134 p refs
(Contract AF 29(601)-5399)
(WL-TDR-64-62, Vol. II; AD-607408)

PREDICT is an IBM 7090/7094 program that automatically solves, from a description of the network topology, built-in differential and algebraic matrix equations that completely characterize the behavior of a complex network. The general approach in the PREDICT formulation does not limit it to radiation applications; the radiation problem is treated as a special case of the general circuit analysis problem. A detailed description of PREDICT, a discussion of its use and operation, and example problems are included to demonstrate and verify its operation at other computing facilities. Information on machine requirements and off-line equipment necessary for the PREDICT system is presented. Author

N65-10237# International Business Machines Corp., Owego, N.Y. Radiation Effects Dept.
AUTOMATED DIGITAL COMPUTER PROGRAM FOR DETERMINING RESPONSES OF ELECTRONIC SYSTEMS TO TRANSIENT NUCLEAR RADIATION. VOLUME I: DEVELOPMENT AND APPLICATION OF DIGITAL COMPUTER PROGRAMS Second Annual Report, 21 May 1963–1 Apr. 1964
Kirtland AFB, N. Mex., AF Weapons Lab., Aug. 1964 105 p refs
(Contract AF 29(601)-5399)
(WL-TDR-64-62, Vol. I; AD-607533)

The development and application of digital computer techniques to the prediction of circuit response to transient nuclear radiation and to the treatment of component data in transient radiation fields are under investigation. Equivalent circuits, component studies, and dosimetry and instrumentation are discussed. This volume is divided into three sections: The first section describes the basic transistor, diode, and capacitor equivalent circuits that are used in the analysis of circuits in radiation environments. The second section points out recognized limitations of the standard equations and describes experimental efforts to better define their range of validity and general utility. Routine dosimetry of radiation effects tests, using pulsed reactor facilities and flash X-ray machines, is discussed in the third section. P.V.E.

N65-10253# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
THE UNDECIDABILITY OF THE EQUIVALENCE PROBLEM FOR PROGRAM SCHEMATA Scientific Report No. 1
David Luckham and David Park 7 Aug. 1964 33 p refs *Its* Rept.-1141
(Contract AF 19(628)-3995)
(AFCRL-64-664; AD-607726)

This paper is concerned with the equivalence problem for program schemata, i.e., for programs written in a certain formal language. This language is designed to express certain general aspects of computer programs, in particular, the dependence between computational blocks, branching, and storage allocation. It is shown that the equivalence problem for program schemata is undecidable. Author

N65-10336# International Business Machines Corp., Owego, N.Y.
PULSED RADIATION EFFECTS ON AEROSPACE DIGITAL COMPUTERS
Kirtland AFB, N. Mex., AF Weapons Lab., Oct. 1963 223 p
(Contract AF 29(601)-5399)
(RTD-TDR-63-3051; AD-423083)

The test objectives were to observe and analyze the behavior of components and circuits used in aerospace digital computers during short, high-intensity, nuclear radiation pulses. Several types of burst sensors are compared, and the dosimetry for both the SPRF and flash X-ray radiation environments is discussed in detail. Considerable advancement was made in the development and application of computer programing techniques that permit automated digital-computer circuit analysis of the effects of pulsed nuclear radiation on typical aerospace digital computer circuits. Four of these computer programs are presented. Author

N65-10353# General Motors Corp., Indianapolis, Ind. Allison Div.
ANALYSIS OF SOLAR REFLECTORS. MATHEMATICAL THEORY AND METHODOLOGY FOR SIMULATION OF REAL REFLECTORS Final Report
G. L. Schrenk and D. G. Gritton 16 Dec. 1963 130 p refs
(Contract AF 04(695)-335)
(EDR-3693; AD-602870)

A mathematical model for analysis of actual solar reflectors is formulated. This model makes it possible to calculate the energy flux on any arbitrarily shaped focal surface from any arbitrarily shaped reflector surface. Provisions are included for treating random surface errors on the reflector surface, orientation errors of any size, and vignetting of reflected radiation by a cavity opening. No approximations were introduced into this model. Operative computer programs for evaluating solar

reflectors were developed from these equations. Details concerning these programs are also presented. Author

N65-10381# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NEW ELECTRONIC COMPUTERS FOR ENGINEERING AND PLANNED-ECONOMY CALCULATIONS
V. I. Loskutov 22 Sep. 1964 10 p Transl. into ENGLISH from Stanki i Instrument (USSR), no. 1, 1964 p 26-28
(FTD-TT-64-631/1+2+4; AD-607122)

The domestic industry has developed and is producing new digital computers Minsk-2 and Promin' to perform planned-economy calculations, and deal with scientific and engineering problems. Applications of these machines in scientific research and construction organizations are promoting a significant expansion in the area of theoretical research, and they are helping to perform complex engineering calculations. The use of electronic computers for economic analysis and planning makes feasible a scientific approach to questions determining the economy in heavy industry regions and plants. The Minsk-2 provides automatic programing for program-controlled machine tools. Author

N65-10391# Honeywell, St. Paul, Minn.
TRAINABLE FLIGHT CONTROL SYSTEM INVESTIGATION
Fred B. Smith, Jr., John F. L. Lee, Arthur R. Butz, and Gregory J. Prom Wright-Patterson AFB, Ohio, Flight Dyn. Lab., Aug. 1964 188 p refs
(Contract AF 33(657)-11316)
(FDL-TDR-64-89; AD-607441)

The investigations reported are concerned with synthesis of adaptive control systems. It is assumed the plant motion over short time periods can be reasonably represented by constant coefficient ordinary differential equations of known form. The adaptive control systems considered are mainly characterized by the capabilities for adapting to general changes in plant dynamics, i.e., arbitrary changes in plant coefficients, and by the modest requirements on the arithmetical capabilities of the control computer. The report shows that these objectives can be obtained by performing extensive computations during the control design phase and by storing the solutions in a special manner. Author

N65-10402# Army Missile Command, Huntsville, Ala. Electromagnetics Lab.
A DIGITAL SQUARE-ROOT COMPUTER
Gerald W. Price 17 Sep. 1964 23 p refs
(RE-TR-64-19; AD-450661)

A need existed for square-root computations that could be utilized for a hard-wired special-purpose airborne application where speed and simplicity of equipment are of prime importance. The computer must also use compatible computing methods presently in use for processing optical data. The method of extracting the square root for this application is derived from the fact that the square of a particular integer may be obtained by adding that particular number of successively increasing integers in the ordinary sequence of odd numbers. The proposed computer can be contained in a very small package by using microminiature high-speed logic and may be used for many applications. Complete mechanization and detailed design are included, along with test results of a complete working model. Author

N65-10411# Stanford Research Inst., Menlo Park, Calif.
GRAPHICAL DATA PROCESSING RESEARCH STUDY AND EXPERIMENTAL INVESTIGATION Quarterly Progress Report No. 4, 1 Apr.-30 Jun. 1964
G. H. Ball, A. E. Brain, G. H. Burch, and D. J. Hall Jul. 1964 62 p refs
(Contract DA-36-039-AMC-03247(E))
(Rept.-16; AD-448597)

Some results are given on the performance of MINOS II in learning to recognize 15 military symbols presented in 5 positions of displacement and rotation. The measurements include the Hamming distances between code words generated by the 100-image optical preprocessor for the various patterns, with a diagnosis of the sources of random variations in code words. Further details are given on the design of the interface logic between MINOS II and the SDS 910, including the operation of the ternary input buffer for MINOS II. Preliminary results are presented for a new technique termed ISODATA, which splits up raw data into groups of patterns clustered around points defining the best average pattern for each group. The method provides for fractionating groups that are not tightly clustered, and for joining together clusters that are so close that the separation is not significant. Author

N65-10412# State U. of Iowa, Iowa City
DATA ACQUISITION AND REDUCTION. PHASE 4: ANALYSIS OF DATA TRACES OF VERY SHORT DURATION
James Hurt and Philip Francis 20 May 1963 59 p ref
(Contract DA-508-ORD-1232)
(Rept.-7; AD-413033)

This report presents an amplification of the methods presented in the previous (Phase 3) report in which numerical methods were developed for finding and isolating the component parts of a transducer output. In the present report, two field-data traces of unknown content are reduced to their fundamental harmonic components. A detailed discussion for each analysis is given, along with comparisons between the original traces and the approximate representations as deduced in the analysis. Each discussion is augmented with several graphs showing the progress of the reduction at each stage in the analysis. Author

N65-10448# Atomic Energy of Canada Ltd., Chalk River, Ontario
A GENERAL PURPOSE DIGITAL READ-OUT SYSTEM FOR KICKSORTERS AND SCALERS USING RELAY LOGIC
W. D. Howell and W. R. J. Shorey Jul. 1964 100 p
(AECL-2041; ELI-85) Available from Atomic Energy of Canada Ltd., Chalk River: $2.00

A general purpose serial digital read-out system using relay logic is described that is capable of recording data at 10 digits per second, either in typewritten and/or punched tape format (8-hole IBM or 7-hole Datatron). The report is divided into three sections. The first section briefly describes the system, together with some typical assemblies. This is followed by a detailed description of the several units comprising the system and of the facilities provided for augmenting the system to meet specific experimental requirements. The third section is devoted to brief notes on maintenance. Author

N65-10465# State U. of Iowa, Iowa City
DATA ACQUISITION AND DEDUCTION. PHASE VI, PART II: FEASIBILITY STUDY FOR REDUCTION AND ANALYTIC APPROXIMATION OF DATA RECORDS

Royce E. Beckett 3 Sep. 1963 22 p refs
(Contract DA-508-ORD-1232)
(Rept.-8; AD-418417)

This report presents the results of a feasibility study on the prospects of obtaining reliable prediction formulas for behavior on the basis of data records. When a suitable sample of traces is available, it is concluded that formulas can be derived that will serve to predict the reproducible elements of the behavior. The probability that some parameter in the response will be within a given tolerance can also be established. Author

N65-10533# Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO. 120
5 Nov. 1964 106 p refs Transl. into ENGLISH of selected articles from CHINESE periodicals
(JPRS-27228; TT-64-51483) OTS: $4.00

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N65-10542# European Atomic Energy Community, Brussels (Belgium)
STUDY AND EXECUTION OF ANALOG-DIGITAL COMPUTING AT EURATOM
A. De Broux, H. d'Hoop, and A. Riotte *In its* EURATOM's Sci. Activities—Joint Nucl. Res. Center, Ispra Establ. 1964 9 p refs (See N65-10541 01-23) Available from the Belg. Am. Bank and Trust Co., N.Y., Account No. 22.186: 450 Belg. Fr.

Two types of linkage between analog and digital computers are considered—static linkage, which places the analog computer under the direct or indirect control of the digital computer in the problem setup phase; the APACHE code and its technical and programing developments are described; and dynamic linkage, corresponding to a particular form of the hybrid concept suitable for big, general-purpose computing centers. Work and studies in these fields are described, and the corresponding exhaustive bibliography is given. Author

N65-10625# Federal Aviation Agency, Atlantic City, N.J. Evaluation Div.
EVALUATION OF TIME-OF-DAY MAGNETIC TAPE STORAGE AND RETRIEVAL EQUIPMENT Final Report
C. Chapman May 1964 51 p refs
(RD-64-72)

An evaluation of Time-of-Day Magnetic Tape Storage and Retrieval (TMTSR) equipment was performed at the National Aviation Facilities Experimental Center (NAFEC) to determine the capability of the equipment to provide a binary coded decimal (BCD) time-of-day reference that could be used for time correlation of voice recordings on magnetic tape equipment within an Air Traffic Control (ATC) Facility. Accuracy of the BCD time-of-day reference was determined using photographic techniques in conjunction with time references obtained from the NAFEC Range Control Central Facility and radio station WWV. Time-of-day continuity data were obtained by controlled data recording and systematic observations during reproduction of the BCD time-of-day reference. It was concluded that the equipment was capable of generating precise BCD time-of-day indices for the purpose of time correlation of magnetic tape voice recordings. Author

N65-10647# Joint Publications Research Service, Washington, D.C.
DEVELOPMENT AND PRINCIPLES OF AUTOMATIC CONTROL SYSTEMS
13 Nov. 1964 181 p refs Transl. into ENGLISH of 4 articles from Avtomat. i Telemekh. (Moscow), v. 25, no. 6, 1964 p 747–851
(JPRS-27359; TT-64-51615) OTS: $5.00

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1. PROBLEMS OF TECHNICAL CYBERNETICS IN THE INSTITUTE FOR AUTOMATION AND TELEMECHANICS V. A. Trapeznikov p 1–8
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N65-10665# Michigan U., Ann Arbor, Mich. Coll. of Literature, Science, and the Arts
UNIVERSALITY IN THE VON NEUMANN CELLULAR MODEL
J. W. Thatcher Sep. 1964 109 p refs
(Contract Nonr-1224(21); Grants DA-ARO(D)-31-124-G588; NSF GP-2539)
(AROD-4049-7; AD-449880)

The von Neumann cellular automaton model is described, and designs within this model are presented for objects that behave like tape and constructing units. An algorithm is developed for embedding in the cellular structure any automaton that effectively manipulates the tape and constructing units. The algorithm is based on a very simple language in which the behavior of such machines can be described. Universality of construction and computation, as well as automaton self-reproduction, is discussed relative to the von Neumann model.
Author

N65-10686*# Stanford U., Calif. Stanford Electronics Labs.
AN ANTENNA ARRAY FOR RADAR ASTRONOMY STUDIES IN THE 20 TO 55 Mc RANGE Technical Report No. 3 and No. 8
H. T. Howard 15 Aug. 1964 23 p refs
(Grant NsG-377; Contract AF 19(604)-7436)
(NASA-CR-59450) OTS Prices: HC $1.00/MF $0.50

This report discusses the design and construction of a branch-fed, variable-phase, 20- to 60-Mc array of 48 log-periodic elements. Phasing to control beam direction is described, and the correction necessary for ionospheric refraction is presented in terms of vertical incidence critical frequency. The array gain as measured by moon-bounce techniques is found to be in good agreement with the theoretical value.
Author

N65-10857# Joint Publications Research Service, Washington, D.C.
AUTOMATED SYSTEMS OF CONTROL BY MEANS OF COMPUTER EQUIPMENT FACILITIES
V. I. Loskutov 19 Nov. 1964 10 p Transl. into ENGLISH from Liteynoye Proizv. (Moscow), no. 8, 1964 p 23–26
(JPRS-27441; TT-64-51690) OTS: $1.00

The organization of a centralized system of controlling foundry production into a single continuous complex of interconnected processes using computer facilities is described. Since foundries are among the industries where the need remains for a significant amount of manually controlled operations, a three-step scheme of data collection and processing is required to assure the operative staff the necessary data for controlling local operations. The first step includes centralized control devices with manually controlled information panels and automatic data-collection devices that act as advisors. The second step of the complex consists of a powerful computer for primary handling of information from the previous equipment and from the operators of the manually controlled units. The third step is the central-control computer that, using input data generated by the second-step equipment, surveys the general situation and solves problems, thus assuring normal operation of local units and of the whole factory.
M.P.G.

N65-10949# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Aachen (W. Germany) Inst. für Theoretische Gasdynamik
A PROGRAM FOR READING OUTPUT DATA OF MEASURING INSTRUMENTS ON THE DIGITAL COMPUTER Z_{22R} [EIN LESEPROGRAMM ZUR BEARBEITUNG VON MESSDATEN AUF DER ELEKTRONISCHEN RECHENMASCHINE Z_{22R}]
August Krau May 1964 31 p refs In GERMAN; ENGLISH summary
(DLR-FB-64-04; DVL-309) Available from DVL, Munich: 7.60 DM

A program has been successfully used for reading output data of measuring instruments having special word structure, punched on a five-channel paper tape. This program is given for the digital computer $Z_{22\ R}$, and the controls for examination of false punch or false reading are described in detail.
Author

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N65-10009# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ELECTROMETRIC AMPLIFIER
B. I. Zarkhin, M. A. Pushkin, and M. Ye. Slutskiy 5 May 1964 11 p refs Transl into ENGLISH from Pribory i Tekhn. Eksperim. (USSR), no. 4, 1963 p 10–94
(FTD-MT-64-09; AD-602582)

An electrometric amplifier for the measurement of direct current in range 10^{-11} to 10^{-15} A is described. The amplifier uses an I-1 straight-filament electrometric pentode of rod construction, working in a circuit with the control of the first grid. One of the basic parameters of the electrometric amplifier is the magnitude of the current of the first-cascade control grid. For the purpose of lowering this current the electometric cascade usually works at low anode voltage, and a measured signal passes onto the second or third grid of the tube. Under these conditions, because of the low transconductance of the tube, the voltage amplification factor of the cascade does not exceed 1 to 2.
Author

N65-10023# Harry Diamond Labs., Washington, D.C.
LOW-COST, HIGH-EFFICIENCY MICROWAVE OSCILLATORS
Morris Campi 18 Oct. 1963 15 p ref
(HDL-TR-1177; AD-422900) OTS: $0.50

L-band pulse oscillators were constructed utilizing the distributed parameter properties of strip transmission line circuitry and the high-frequency characteristics of ceramic planar triodes. The entire circuit is fabricated in low-cost printed circuitry, and the tube is the only additional component. Peak powers up to 1000 watts are delivered at 1200 Mc with 30- to 35-percent efficiency. The frequency stability is 1 Mc over the −50° to 80° C temperature range. Vibrations of 50 to 2000 cps at 15 g produce less than 1 Mc frequency deviations.
Author

N65-10041# Microwave Associates, Inc., Burlington, Mass.
HIGH POWER SEMICONDUCTOR PHASE SHIFTING DEVICES Quarterly Progress Report, 1 Apr.–30 Jun. 1963
Joseph White Oct. 1963 67 p
(Contract NObsr-87291)
(OPR-6; AD-421891)

An introduction is presented summarizing the role of the diode phase shifter both as a high-power array-antenna beam-steering element and as a low-power-countermeasure phase jammer or instrument level phase-trimming network for microwave impedance measurements or synchronization of parallel high-power tubes. Canonical circuit configurations for the transmission–reflection mode used at low power for continuous phase shifting and at high power for time delay, as well as the transmission mode used to obtain small phase shifts at high power, are discussed. An L-band experimental transmission circuit is described that yielded 5° of phase shift using two 800 V PIN diodes at 120 kW; operating frequency was 1300 Mc, pulse length was 1μsec, and the duty cycle was 0.001. An S-band transmission phase shifter circuit was also considered. Author

N65-10049# Naval Research Lab., Washington, D.C.
HIGH-CURRENT TUNNEL DIODES
D. M. Horan and P. E. V. Shannon *In its* Rept. on NRL Progress Apr. 1964 p 1–6 refs (See N65-10048 01-23) OTS: $1.25

The feasibility of making high-current tunnel diodes has been demonstrated by the completion of the first few. Diodes were produced with peak currents of 40 A, and one had a current peak as great as 75 A. The peak-to-valley current ratio, however, was only 2:1 because of inadequate heat removal. The tunnel-diode p-n junctions were formed by the alloying process. The heat was provided either by a strip heater, by prefocussed movie projector lamps, or by an oven. The heating process was varied to determine its effect on the tunnel-diode characteristics. Results indicated that the tunnel-diode characteristics were a function of the kind of materials used and that good junction-forming techniques were necessary to insure that these determined characteristics were approached. Author

N65-10129# Joint Publications Research Service, Washington, D.C.
MEASURING CIRCUITS FOR BALANCING ALTERNATING CURRENT
G. A. Shtamberger *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 19–25 refs (See N65-10126 01-14) OTS: $6.00

The article considers a version of the classification of balancing measuring circuits—bridge and compensation—using as primary criteria the purpose of the circuit, and the regime and conditions of measurement. The classification combines groups of circuits having basically identical properties, and facilitates their analysis and synthesis. Author

N65-10130# Joint Publications Research Service, Washington, D.C.
MEASUREMENT OF THE PHASE SHIFT BETWEEN TWO VOLTAGES OF DISTORTED FORM
S. M. Mayevskiy and Yu. A. Skripnik *In its* Izv. VUZov: Instr Bldg., No. 4, 1964 27 Oct. 1964 p 26–33 refs (See N65-10126 01-14) OTS: $6.00

A trigger phase-metering system is described that has a single tunable filter inserted at the input of the measuring channel. Both input voltages are applied to this channel in turn by means of a two-channel electronic switch, whose switching frequency is selected well below the frequency of the input voltages. At the output of such a phase-angle metering system, a low-frequency voltage is obtained at the switching frequency whose amplitude is proportional to the measured phase shift. Author

N65-10131# Joint Publications Research Service, Washington, D.C.
STATIC CONVERTER OF POWER INTO DC VOLTAGE USING BALLAST DIODES WITH USE OF PIECEWISE-LINEAR PARABOLIC APPROXIMATION
A. V. Fremke, D. N. Mokiyenko, and O. S. Shevegzhda *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 34–38 refs (See N65-10126 01-14) OTS: $6.00

An attempt was made to extend the methods of calculation and evaluation of the reliability of electronic equipment to the measuring equipment. The results of the calculations are presented. Calculation of the mean time T_m of proper operation for the case when the loading coefficient k_H equals 1 is presented only for comparison with the real regime for which k_H is about 0.2. The mean time of proper operation of the transducer lies in the region 2250 to 2340 hours, i.e., $T_m > 2000$ hours. Author

N65-10132# Joint Publications Research Service, Washington, D.C.
THE STATIC ACCURACY OF DIGITAL INSTRUMENT DEVICES OF THE SERVO TYPE
V. Yu. Konchalovskiy *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 39–46 refs (See N65-10126 01-14) OTS: $6.00

A study is made of the relationships between the level quantizing interval, the instrumental error, and the sensitivity threshold for digital instrument devices of the servo type. Author

N65-10133# Joint Publications Research Service, Washington, D.C.
PRINCIPLE OF DESIGN OF NULL-DEVICE FOR ALTERNATING CURRENT COMPENSATING CIRCUITS BASED ON THE PHASE CHARACTERISTIC
T. M. Aliyev and V. P. Stepanov *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 47–57 refs (See N65-10126 01-14) OTS: $6.00

This paper considers one of the possible principles of design of null devices for alternating current dynamic compensators, and also the factors relating the duration of the measurement cycle with the error and the frequency at which the measurement is made. Author

N65-10134# Joint Publications Research Service, Washington, D.C.
DESIGN OF A BRIDGE CIRCUIT USING A SEMICONDUCTOR THERMISTOR AND AN ELECTRON TUBE AMPLIFIER
V. Ya. Rubashko *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 58–68 refs (See N65-10126 01-14) OTS: $6.00

This paper presents a method of analysis of dc bridge circuits, using a semiconductor thermistor (ST) and a vacuum tube amplifier in the measuring diagonal. The analysis is based on the limitation of the maximum error introduced by the thermistor (to a prespecified magnitude) and on obtaining an instrument scale that is nearly linear. Author

N65-10135# Joint Publications Research Service, Washington, D.C.
AMPLIFIER-SHAPERS FOR SHORT CURRENT PULSES
I. Gula and V. E. Gurevich *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 69–75 refs (See N65-10126 01-14) OTS: $6.00

Two circuits of power-transistorized amplifier-shapers for short current pulses intended for operation in a magnetic operational memory device, with access time of the order of 1 microsecond, are considered. Features of the proposed circuits are operation of the output transistor in the amplifying region of the output characteristics and the nonlinear feedback circuit used for the stabilization of the position of the operating point of the output transistor. Author

N65-10136# Joint Publications Research Service, Washington, D.C.
CLASSIFICATION OF PHASE-SENSITIVE CASCADES IN TERMS OF THE OUTPUT POWER
D. I. Zorin and E. I. Rodion *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 76–80 refs (See N65-10126 01-14) OTS: $6.00

A classification is presented of phase-sensitive cascades based on the power of the commutating and controlling signals for obtaining the output power and the most common circuits. Author

N65-10149# Joint Publications Research Service, Washington, D.C.
HEAT AND MASS TRANSFER IN ELECTRONIC EQUIPMENT OF MODULAR CONSTRUCTION
G. N. Dul'nev and A. M. Karapetyan *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 181–189 refs (See N65-10126 01-14) OTS: $6.00

This paper discusses the theoretical fundamentals of the method of analysis and design of the thermal regime of perforated electronic equipments of modular construction with an arbitrary number of heated zones along the height. Author

N65-10202# Little (Arthur D.) Inc., Cambridge, Mass.
METHODS FOR LOW POWER TEMPERATURE CONTROL Final Report, 1 May 1963–30 Apr. 1964
Igor A. Black [1964] 94 p
(Contract DA-36-039-AMC-02207(E))
(AD-447542)

This report describes work done on an investigation of methods, techniques, and devices by which the temperature of a quartz crystal can be maintained, with a minimum of power, at a nominal operating temperature over environmental temperature extremes. The work includes investigations of second-order effects applicable to the design of low-power crystal ovens. End products resulting from the study are three types of ovens: (1) a 3-in.^{3}, 500-mW oven requiring accessibility to the crystal and operating at +75° ±1° C over a −55° to +60° C ambient; (2) a 1.5-in.^{3}, 100-mW sealed oven with similar operating requirements; and (3) a 4-in.^{3}, 250-mW oven requiring accessibility to a chamber capable of housing two crystals and operating at 0° ±1° C over a −55° to 0° C ambient. Author

N65-10204# Electric and Musical Industries, Ltd., Hayes (Gt. Brit.)
HIGH POWER KLYSTRON AMPLIFIER OUTPUT CIRCUITS AND THE EFFECTS OF A MISMATCHED LOAD
M. J. Smith May 1964 34 p refs
(RF/288; AD-445153)

A single- and double-tuned output cavity for a high-power klystron amplifier were analyzed, and the results were found to agree fairly well with practice. Because the load conductance is small compared to the beam conductence, the output power variation with the phase of a mismatch in the output line is considerable even for small mismatches, and this can have a sizable effect on the predicted performance of the tube. Author

N65-10241# Varian Associates, Palo Alto, Calif. Central Research Lab.
SOLID STATE MICROWAVE AND POWER DEVICES. VOLUME I: INTEGRATED AMPLIFIER Final Technical Documentary Report
H. Kroemer Wright-Patterson AFB, Ohio, AF Avionics Lab., Oct. 1964 76 p refs
(Contract AF 33(657)-11015)
(AL-TDR-64-258, Vol. I; AD-607986)

The objective of the integrated amplifier project reported in this volume was to study solid-state amplifiers that utilize the negative resistance of tunnel diodes, as an amplifying mechanism, in combination with the nonreciprocity of the Hall effect. This can be achieved by connecting tunnel diodes across either the input or the output of a Hall isolator. Hall isolators are four-terminal semiconductor devices similar to Hall generators that permit unidirectional signal transmission, like ferrite isolators. Compared to the latter they are inherently broadbanded, including dc operation, but they are also lossy. Losses below 10 dB can easily be achieved. The impedance of Hall isolators can easily be made to match that of tunnel diodes. By combining the two devices the diodes can be operated close to critical matching, producing amplification large compared to the insertion loss of the isolator and resulting in substantial overall unidirectional gain, combined with excellent stability. Author

N65-10247# Westinghouse Electric Corp., Youngwood, Pa.
PRODUCTION ENGINEERING MEASURE TYPE 2N1814 SILICON ALLOY TRANSISTOR Quarterly Progress Report, 1 Apr.–30 Jun. 1964
M. F. Amsterdam, D. L. Moore, R. J. Pisarcik, and W. E. Shopsky [1964] 20 p
(Contract DA-36-039-AMC-03617(E))
(QPR-4; AD-605842)

The status of all phases of the reliability improvement program is presented. Progress made, and difficulties encountered causing a delay in the performance of each task are described. The installation of pulse peak power test equipment and data recorded from the initial probe are reported. Author

N65-10310# General Electric Co., Auburn, N.Y. Rectifier Components Dept.
DEVELOPMENT AND EVALUATION OF A BILATERAL TRIODE SWITCH First Quarterly Progress Report, 13 Apr.–13 Jul. 1964
F. E. Gentry [1964] 33 p refs
(Contract NObsr-91151)
(QPR-1; AD-603560)

This report describes the work performed on the development of an improved bilateral triode p-n-p-n switch. In addition to a qualitative description of the operation of this new device, calculations of the sheet conductivity of double-diffused layers and of some of the effects of transverse current flow in such layers are presented. Author

N65-10317# Edgerton, Germeshausen and Grier, Inc., Boston, Mass. Tube Research and Development Dept.
DEVELOPMENT OF A SUPER POWER DEUTERIUM THYRATRON First Quarterly Report, 12 Jun.–12 Sep. 1963
N. Reinhardt 8 Nov. 1963 22 p
(Contract NObsr-89405)
(B-2684; AD-422726)

This paper pertains to the development of a superpower deuterium thyratron tube. The fabrication specifications are presented, and the results of three starts discussed. A thorough analysis of the basic superpower deuterium thyratron was prevented by the short life and the high emission drop of the tube. G.G.

N65-10323# SFD Labs., Inc., Union, N.J.
PRODUCTION ENGINEERING MEASURE FOR A Ka-BAND INVERTED COAXIAL MAGNETRON Fourth Quarterly Progress Report, 7 Feb.–6 May 1964
P. Du Fosse and G. Glenfield May 1964 25 p *Its* Rept.-4
(Contract DA-36-039-AMC-01472(E))
(SFD-29-QPR-4a; AD-604346)

Thirteen model tubes were built and evaluated, the results of which are presented. Initial life test results are reported, as are the results of the completed heater cycle life tests. The results of the anode evaluation program, which yielded high Q_u, broadband, low-voltage anodes, are discussed. Author

N65-10343# Oak Ridge National Lab., Tenn. Neutron Physics Div.
PERFORMANCE CHARACTERISTICS OF MODULAR NANOSECOND CIRCUITRY EMPLOYING TUNNEL DIODES
N. W. Hill, R. J. Scroggs, J. W. Mc Connell, and J. M. Madison Oct. 1964 38 p refs
(NASA Order R-104; Contract W-7405-ENG-26)
(ORNL-3687) OTS: $1.00

Tunnel diodes have been used in the design and construction of a variety of modular circuitry used in instrumentation for high-energy particle experiments. Modules included fast- and slow-recovery discriminators, fast- and slow-recovery coincidence modules, positive- and negative-output scaler drivers, and a 100-Mc scaler driver. The individual univibrators used in the circuitry and the completed modules have been subjected to extensive tests to determine the effects of variations in operating temperature and in input pulse magnitude on resolution, pulse shape, walk, and thresholds. It was found that circuitry using tunnel diodes is strongly affected by such variations, as well as by fluctuations in the power supply. It was also noted that parameter differences between supposedly identical tunnel diodes produced significantly large variations in module behavior. It is concluded that the modular circuits discussed and shown in this report are satisfactory for their intended purposes, but that maximum performance and stability can be assured only by individual selection and testing of the tunnel diodes and by regulation of power supplies to ±0.01% for both line and load. An appendix gives some general details of the construction of the modules. Author

N65-10354# Bendix Corp., Ann Arbor, Mich. Bendix Systems Div.
RADIATION EFFECTS PARAMETERS IN NAP APPLICATIONS Eighth Monthly Progress Letter, Apr. 1964
R. M. Magee et al 15 May 1964 7 p ref
(Contract AF 29(601)-5911)
(BSR-940; AD-447844)

Cobalt-60 gamma-ray tests of four transistor types by exposure to 9.6×10^7 roentgens were performed. A sensitivity of gain to the operating history immediately preceding the gain measurements of several operating points was observed. Successive measurements within a short time period resulted in gain increases. After removal of the power, the devices returned to a low gain condition while in the gamma-ray environment. G.G.

N65-10369*# Thompson Ramo Wooldridge, Inc., Cleveland, Ohio TRW Electromechanical Div.
OPTIMIZATION STUDY OF HIGH POWER STATIC INVERTERS AND CONVERTERS Second Quarterly Report, Nov. 1, 1963–Jan. 31, 1964
R. G. Klimo, A. B. Larsen, and J. E. Murray 20 Apr. 1964 164 p refs
(Contract NAS3-2785)
(NASA-CR-54021) OTS Prices: HC $5.00/MF $1.25

A detailed study was made to determine quantitatively the relative merits of design schemes for the 3200-cycle, 10-kW inverter. Items discussed include the design and use of iron-core components, circuits using three-phase transformers, the internal impedance of power-switching stages and filters, feedback techniques for minimizing drive requirements, and power-stage redundancies for reliability improvements. In order to provide a definite basis for comparison, inverters utilizing both silicon-controlled rectifiers (SCR's) and transistors were designed and analyzed. Different circuits were used for the different switching elements to make fullest use of advantages of each. Because weight and efficiency are of importance in aerospace applications, these areas were given emphasis. D.S.G.

N65-10393# General Electric Co., Holyoke, Mass. High Voltage Specialty Transformer Section
HIGH POWER, HIGH VOLTAGE, AUDIO FREQUENCY TRANSFORMER DESIGN MANUAL Final Report, 1 Jul. 1962–31 Aug. 1964
J. G. Howe, R. D. Smith, J. J. Kingsley, and R. E. Gearhart 31 Aug. 1964 662 p refs
(Contract NObsr-87721)
(AD-607774)

Discussed are the transformer mechanical and electrical specifications, the test requirements, and the effect of the specifications on the transformer size, weight, and cost. Also included are an analysis of various transformer equivalent circuits and a brief outline of the transformer design procedure. The audiofrequency transformer design procedure is presented in a step-by-step outline. Each step is briefly described, all necessary equations are listed and defined, and pertinent factual data are presented in tables and curves. The procedural detail used to calculate the various parameters needed in the step-by-step design is presented and includes a thorough discussion of theory, experimental data, and calculated data for winding arrangements, insulation structures, frequency response parameters, core and copper losses, cooling, distortion, shielding, and mechanical construction for the audiofrequency transformer. Author

N65-10417# Microwave Associates, Inc., Burlington, Mass.
KA-BAND CRYSTAL PROTECTOR Second Quarterly Progress Report, Jun. 15–Sep. 15, 1963
Paul Basken [1963] 42 p
(Contract DA-36-039-AMC-00157(E))
(Rept.-2; AD-423100)

A series of resonant element sections were investigated to experimentally determine the optimum filter configuration for the gas crystal protector. Some low-level work was carried out on the gas pre-TR and on the solid-state limiter designs. Life tests on two different types of crystal protectors were conducted to expose problem areas in the designs under consideration. Wall treatment processes and gas-fill composition were analyzed in these tests. A preliminary conclusion as to the merits of the several approaches was advanced, but more experimental support will be required to establish the finalized design. Author

N65-10418# Tung-Sol Electric, Inc., Bloomfield, N.J. Research Div.
HIGH SPEED POWER AMPLIFIER USING ELECTRON BEAM SWITCHED P-N JUNCTIONS Interim Development Report, 26 Jun.–26 Sep. 1963
31 Oct. 1963 40 p refs
(Contract NObsr-89493)
(AD-422530)

A design theory has been developed for the diode. It indicates the possibility of fabricating devices having a gain close to the maximum of 4700. High transconductance, low cutoff, high beam current electron guns have been designed for this project. Preliminary experimental electron beam multiplier (EBM) tubes have been made with gains (ratio of diode current to beam current) of 3300 minimum, and diode currents of 2.0 A. These tubes employed shallow (3 micron) p-n junctions in silicon with an evaporated cover layer (1500 Å) of aluminum. The diode leakage current was in the order of 1 μA at 200 V. Beam voltage was 20 000 volts. Author

N65-10423# Electromagnetic Technology Corp., Palo Alto, Calif.
FREQUENCY CONVERTER UNITS FOR L-BAND, S-BAND, C-BAND AND X-BAND Interim Development Report, 1–31 Oct. 1963
Lyle C. Bacon et al 15 Nov. 1963 11 p
(Contract NObsr-89536)
(IDR-4; AD-423079)

The preliminary model of the high-pass filter for L-band was tested, and performed as expected. At the local-oscillator frequency, 40 dB of rejection was obtained. Maximum insertion loss in the pass band was 1 dB. The band-pass filters for X-band and L-band were partially tested. The first had acceptable insertion loss and VSWR at the center frequency. The two models of the L-band filters tested had excessive loss in the pass band. Measurements were made in X-band of the characteristics of the Sage crystal holder. An equivalent circuit applicable to this holder was derived to simplify and to speed up measurements of element values and calculation of crystal impedance. Author

N65-10424# Electromagnetic Technology Corp., Palo Alto, Calif.
FREQUENCY CONVERTER UNITS FOR L-BAND, S-BAND, C-BAND, AND X-BAND Interim Development Report, 1–31 Jul. 1964
Lyle C. Bacon 15 Aug. 1964 14 p
(Contract NObsr-89536)
(IDR-13; AD-603765) OTS: $1.00

An L-band converter was constructed that meets all specifications at low signal levels. Experiments were conducted on an S-band converter similar to the L-band converter. A converter specifically for S-band was designed and is being fabricated. Design work was done and experiments were conducted on components necessary to construct an X-band converter. Improved apparatus for launching the local oscillator and Ka-band signals was fabricated. The high pass filter was modified slightly to improve the local oscillator rejection. Author

N65-10428# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
HIGH SPEED SEMICONDUCTOR SWITCH (TWO TERMINAL) AND HIGH SPEED SEMICONDUCTOR SWITCH (GATE) First Quarterly Report, 29 May–28 Aug. 1963
[1963] 21 p
(Contract DA-36-039-AMC-01475(E))
(AD-423144)

Two varieties of high-speed semiconductor switches are proposed for use in radar modulator and similar pulse-type applications: (1) the SCL 7004/1, a two-terminal, four-layer unit; and (2) the SCL 7004/2, a three-terminal (gated) silicon control rectifier. Objectives are improved switching speeds at high-current levels and improved forward-voltage capabilities. Preliminary die and packaging designs, as well as diffusion and assembly methods, are described. Progress on test-equipment design and lifetime study is also reported. M.P.G.

N65-10442# Army Missile Command, Huntsville, Ala. Electromagnetics Lab.
DYNAMIC MEASUREMENT OF PHASE SHIFT AND AMPLITUDE
John R. Kay 19 Jun. 1964 38 p refs
(RE-TR-64-3; AD-450189)

Test procedures and techniques were investigated for swept frequency measurements of phase and amplitude characteristics of microwave amplifiers and related components, as functions of both time and frequency. Techniques are applicable to production line testing where test time must be minimized but accuracy must be maintained. Data are accurate and comprehensive over a broad frequency range. A reflectometer system is used for swept frequency gain measurements. A commercially available phase test set is used for swept frequency phase measurements. Author

N65-10451# Sperry Microwave Electronics Co., Clearwater, Fla.
HIGH POWER FAST FERRITE SWITCHES Interim Development Report No. 4, 27 Mar.–27 Jun. 1964
Jul. 1964 28 p ref
(Contract NObsr-89428)
(SJ-222-0047-4; AD-603927)

The microwave development of both the C-band and S-band SPDT switches is essentially completed. In each case, the waveguide dimensions have been determined, the final hardware is being fabricated, and the ferrimagnetic material has been chosen. One megawatt peak power operation has been attained with the C-band SPST element in both the transmitted and reflecting conditions. A technique has been developed whereby operation above the subsidiary resonance threshold is possible. Author

N65-10455# Tung-Sol Electric, Inc., Livingston, N.J. Chatham Electronics Div.
RUGGED, CERAMIC, MINIATURE HYDROGEN THYRATRON Final Report, 1 Jul. 1960–28 Jun. 1963

C. L. Shackelford [1963] 136 p refs
(Contract DA-36-039-SC-85061)
(Rept.-9; AD-423374)

The development of the types 8191 and 8192 hydrogen thyratrons is described. The tubes are miniature ceramic envelope types having external anodes and grids. The principal difficulty in the development was concerned with the cathode heaters. The major portion of the time was expended in attempting to meet the initial objectives of 30-second heating times with a 14-watt combined cathode and reservoir heater power. This was not found possible and both power and time were increased. The switching power handling capabilities of the tubes were increased beyond the original proposal. Various tests were performed and reported, and specifications were prepared. Author

N65-10462# Illinois U., Urbana Electrical Engineering Research Lab.
STUDY AND INVESTIGATION OF MILLIMETER AND SUBMILLIMETER WAVE RECEIVER TECHNIQUES Quarterly Report No. 3, 1 Sep.–30 Nov. 1962
M. D. Sirkis et al 22 Feb. 1963 32 p refs
(Contract AF 30(602)-2456)
(RADC-TDR-63-22; AD-298725)

The sensitivity of a triglycine sulfate pyroelectric-effect detector has been increased to 1.9×10^{-10} A/mW at a temperature of 24° C by carefully cutting and aligning the TGS crystal. The use of a cascode-cathode follower amplifier with the detector has decreased the response time to about 30μsec. The power sensitivity of the detector with the amplifier is 7.9 mV/mW at 38.7 Gc; the minimum detectable power is about 17μW. A metal reflecting beam waveguide was built for preliminary testing. A crystal detector mount derived from the biconical spherical resonator is described. This detector mount is well suited for use with beam waveguides. Author

N65-10473# Texas Instruments, Inc., Dallas Semiconductor-Components Div.
OPTOELECTRONIC FUNCTIONAL ELECTRONIC BLOCKS Interim Engineering Report, 1 Feb.–30 Apr. 1964
J. R. Biard 4 Aug. 1964 54 p refs
(Contract AF 33(657)-11552)
(IER-03-64-53; AD-603409)

The program has been divided into two tasks. Task I covers the design and fabrication of optoelectronic functional electronic blocks. The circuit design of the optoelectronic pulse amplifier has been finalized, and the photo mask layout has been completed. A shielded photo diode is employed to provide electrical isolation at all frequencies. Task II is concerned with the semiconductor technology necessary to adequately implement the optoelectronic functional electronic blocks selected for study. The technology investigations reported under Task II include the evaluation of a lead glass for optical coupling, noise measurements on a light emitter–photo diode pair, photoluminescence measurements on GaAs diodes, characteristics of GaAsP light emitters, a slice processing technique for mesa-type light emitters, and measurements on guard-ring diodes. Author

N65-10480# Stanford U., Calif. Microwave Lab.
MULTIMEGAWATT BROADBAND MICROWAVE TUBES Quarterly Status Report No. 10, 1 Feb.–30 Apr. 1964
Marvin Chodorow Griffiss AFB, N.Y., RADC, Sep. 1964 42 p refs
(Contract AF 30(602)-2575)
(RADC-TDR-64-357; AD-607450)

Current work is reviewed as follows: (1) Centipede TWT—Current results of theory and experiment are presented. (2) Periodic Circuit Studies—Modifications of existing circuits and new circuits for high power TWT's for improvement of bandwidth, impedance, and stability are investigated. Evaluation of an unshielded periodic array of small dielectric resonators as a positive-dispersion slow wave structure providing an axial H-field is presented. (3) Oscillation Supression in TWT's—An abstract from a report on TWT oscillation suppression (pulse edge) by means of coupling to an external lossless waveguide is given. (4) Extended Interaction Klystrons—Assembly of an experimental three-cavity tube has been completed. (5) Transverse Wave Studies—Investigation of transverse wave propagation on an accelerated stream is continuing. Author

N65-10481# Syracuse U., N.Y. Coll. of Engineering
FAILURE MECHANISMS OF TUNNEL DIODES Final Report
Glenn M. Glasford, Richard L. Anderson, and Rajendra P. Nanavati Griffiss AFB N.Y., RADC, Sep. 1964 45 p refs
(Contract AF 30(602)-2778)
(EE-959-630TDR-2; RADC-TDR-64-313; AD-607730)

Experimental evidence is presented, which shows that the deterioration in the current–voltage characteristics of GaAs tunnel diodes, when operated at a high forward bias, results from recombination of injected electrons. The recombining electron gives its energy to the acceptor impurity atom and excites it from a substitutional site to an interstitial site. Associated with this Frenkel defect is a rearrangement of electronic states which, in turn, is responsible for the degradation of the current–voltage characteristics. Author

N65-10482# Micro State Electronics Corp., Murray Hill, N.J.
WIDE BAND, LOW NOISE, ALL SOLID STATE ELECTRONICALLY TUNABLE UHF AMPLIFIER Final Report, Mar. 1963–Feb. 1964
Griffiss AFB, N.Y., RADC, Sep. 1964 29 p ref
(Contract AF 30(602)-2967)
(RADC-TDR-64-305; AD-607436)

The purpose of the program was to develop an all-solid-state, electronically tunable, low-noise amplifier covering the frequency range 300 to 1000 cps. The equipment described includes wideband tunnel diode and transistor amplifiers, and two types of electronically tunable filters, one employing magnetic tuning of an yttrium iron garnet resonator, and the other, voltage tuning of a variable capacitance diode. Author

N65-10490# Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J. Solid State and Frequency Control Div.
THE RELATIONSHIP BETWEEN TRANSISTOR SECONDARY BREAKDOWN PERFORMANCE TO VHF LARGE SIGNAL AMPLIFIER PERFORMANCE
Bernard Reich and Edward B. Hakim Jun. 1964 9 p
(TR-2492; AD-607566)

An attempt has been made to find a relationship between transistor secondary breakdown, as noted at low frequencies, with the performance of transistors as vhf large-signal amplifiers. The study tends to indicate that if secondary breakdown limits the performance of rf power transistors, the maximum power output of the device is limited by the dc operating

point at which secondary breakdown occurs. Upon visual inspection of units destroyed in these experiments, it has been found that consistent metalization failures have occurred in the vicinity of the emitter lead, and that failures noted under rf conditions have been much more severe than those noted under dc burnout conditions. Author

N65-10491# Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J. Electron Tubes Div.
REVIEW AND ANALYSIS OF FERRIMAGNETIC MICROWAVE PARAMETRIC AMPLIFIERS
Martin Auer May 1964 28 p refs
(TR-2487; AD-607346)

This report surveys the development of the ferrimagnetic parametric amplifier. Major efforts in this area are described. The theoretical background of the amplifier is developed, taking into account the several operational diversifications. Pump-power threshold, gain, bandwidth, and noise behavior are discussed. Experimental approaches relating to the different modes of operation are presented, together with the results achieved. In the concluding section, an appraisal of the ferrimagnetic parametric amplifier is made by comparison with the diode parametric amplifier and the maser. Author

N65-10495# Sprague Electric Co., North Adams, Mass.
PRODUCTION ENGINEERING MEASURE RELIABILITY IMPROVEMENT JET ETCH TRANSISTOR Quarterly Report, 31 Oct. 1963–31 Jan. 1964
J. N. Edwards, J. H. D. Folster, and R. M. Gagne [1964] 13 p
(Contract DA-36-039-SC-86721)
(QR-7; AD-604692)

Data establishing the reliability of the jet-etch transistor at <.044%/1000 hr are presented herein. The only other area in which there was activity was in delineation where the adaptability of the I_{CBO} method of monitoring delineation to production was further verified. Author

N65-10505# SFD Labs., Inc., Union, N.J.
APPLIED RESEARCH ON EXTENDED INTERACTION IN ICEM MAGNETRONS Interim Engineering Report No. 1, 16 Apr.–16 Jul. 1964
W. R. Zettler Jul. 1964 26 p
(Contract AF 33(615)-1570)
(SFD-42-IER-1; AD-603547)

This report covers a program to explore the feasibility of combining two, three, or more Ka-band interaction structures in cascade to produce an N-tupling of the peak and average power capability of a single stage. Activity to date has progressed in two paths—analytical and mechanical. Analysis of the transmission line problems involved has determined the proper electrical design approach for the early models. The mechanical design, which involves modification of a basic Ka-band ICEM magnetron, has proceeded satisfactorily. Author

N65-10514# Silicon Transistor Corp., Carle Place, N.Y.
PRODUCTION ENGINEERING MEASURE TO INCREASE THE RELIABILITY OF THE TRANSISTOR TYPE 2N2034 Quarterly Progress Report, Apr.–30 Jun. 1964
J. Cocking, J. Courier, F. Des Roches, D. Hughes, and E. Martin [1964] 30 p
(Contract DA-36-039-AMC-01482(E))
(QPR-4; AD-606191)

All work in process improvements is complete. A modified sandblast procedure was determined to be the most satisfactory method for the separation of wafers into pellets. The selection of the most desirable environment was determined by engineering evaluation and confirmed by stability data. Production run was started. The work on reliability evaluation is reported. The results of power step stress tests are presented. Author

N65-10521# Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J. Radar Div.
A NEW TYPE OF DOPPLER SIMULATOR
John L. Kerr Jun. 1964 16 p
(TR-2493; AD-607892)

The design of a new type of doppler simulator is based on a rectangular waveguide in the form of a closed E-plane circular loop fed by a 90-degree H-plane corner. The waveguide loop is divided symmetrically in the plane of the loop. The two sections are so arranged that one, the rotor, may be continuously rotated, while the other, the stator, which contains the input waveguide, remains fixed. The simulator produces a high-speed linear phase shift with relatively low mechanical rotational speed. Target direction, approaching or receding, can be simulated by choosing the appropriate direction of rotation. The device is useful in a laboratory bench setup, as well as for field operation. Author

N65-10616# Harry Diamond Labs., Washington, D.C.
DESIGN OF A NARROW WALL TRANSVERSE SLOTTED WAVEGUIDE ARRAY AT 70 Gc
Francis M. Gray 30 Sep. 1963 29 p refs
(HDL-TR-1152; AD-423320)

Requirements for a low-power, lightweight, ground-ranging radar system operating at 70 Gc (V band) led to the design of narrow-beam array line sources. Narrow-wall transverse slot arrays were designed, using both the Taylor and the uniform aperture distributions. The methods and equations used in the design are discussed. A generalized method of obtaining Taylor aperture distributions, with minimum effort, is presented. A 100-slot array was built using the uniform aperture distribution, and a 164-slot array was constructed using the Taylor aperture distribution. Both arrays were constructed using RG-98/U waveguide. At the design frequency, the 100-slot array had calculated and measured efficiencies of 84% and 81%, whereas the 164-slot array had calculated and measured efficiencies of 86% and 83%, respectively. Measurements taken on these arrays showed that beamwidth and sidelobe levels were within design requirements. Author

N65-10619# Union Carbide Corp., Cleveland, Ohio Linde Div.
ELECTROLYTIC NIOBIUM AND NIOBIUM ALLOY CAPACITORS OF WET AND SOLID TYPES Quarterly Research and Development Report, 1 Jul.–30 Sep. 1963
F. E. Cariou [1963] 62 p
(Contract NObar-87478)
(QPR-5; AD-423316)

This study of electrolytic niobium and niobium-alloy capacitors contains the following topics: "Optimum Anodization Conditions for Niobium Anodes"—Increased formation voltage reduced the capacitance and lowered yield. Prolonged formation times degraded the performance, and ultrasonic electrolyte agitation produced poorer electrical properties. "Optimum Processing Conditions for Solid Niobium Plug

Capacitors"; "Optimum Anodizing Conditions for Niobium Alloy Anodes"; "Optimum Fill Electrolyte for Wet Plug Capacitors"; "Optimum Processing Conditions for Niobium and Niobium Alloy Foil Capacitors"; "Optimum Processing Conditions for Niobium and Niobium Alloy Foils"; "Optimum Fill Electrolyte for Niobium and Niobium Alloy Foil Capacitors", and "Basic Studies of Tantalum and Niobium Single Crystals, Sputtered Films, and Polycrystalline Foils." G.G.

N65-10652# Westinghouse Electric Corp., Elmira, N.Y. Electronic Tube Div.
DESIGN AND DEVELOPMENT INVESTIGATIONS OF A LOW NOISE, LINEAR, VARIABLE GAIN, R.F. AMPLIFIER TUBE Quarterly Progress Report, Jun. 29–Sep. 30, 1963
J. P. Pietrzyk, A. van der Jagt, and R. L. Pear 15 Oct. 1963 44 p
(Contract NObsr-89530)
(QPR-1; AD-422409)

Several triode tests were made in three different basic designs, viz, slotted cathode design, space charge grid type, and conventional triode. Also, extensive distortion calculations were made for a 10-volt peak-to-peak signal. These calculations prove that the power coefficient of the transfer characteristic has far less influence on the distortion than the ratio I/Gm, except for a pure straight line and a pure quadratic characteristic. Test results and calculations give strong evidence that it may be possible to achieve a satisfactory suppression of the interferences with a more or less conventional tube design with specially adjusted characteristics. Author

N65-10668# SFD Labs., Inc., Union, N.J.
APPLIED RESEARCH ON EXTENDED INTERACTION IN ICEM MAGNETRONS Interim Engineering Report No. 2, 16 Jul.–16 Oct. 1964
A. Cook and M. Liscio Oct. 1964 28 p
(Contract AF 33(615)-1570)
(SFD-42-R-2; AD-450599)

Emphasis to date has been directed toward obtaining experimental operating data. Test results obtained by driving a single amplifier stage are available. The mechanical design problem, which involves modification of a basic Ka-band ICEM magnetron has proceeded satisfactorily. A fixed-frequency version of the design has been constructed and tested. A tunable version of the design has been constructed. Author

N65-10685*# Raymond Engineering Lab., Inc., Middletown, Conn.
10^6 BIT ENGINEERING RECORDER/REPRODUCER Final Engineering Report No. 607
F. A. Stone 24 Aug. 1962 83 p
(Contract JPL-950105)
(NASA-CR-59461) OTS Prices: HC $3.00/MF $0.75

The program investigated the following problems: (1) the effects of thermal bacteriological sterilization on a transport mechanism and its electronics; (2) reproduction of NRZ binary data at an extremely low tape speed, which results in a playback-head output less than 100 microvolts peak-to-peak; (3) absolute synchronism and lack of jitter in the reproduced output by means of a phase-locked tape speed control; and (4) minimum size, weight, and power consumption in the final design. Author

N65-10702# Bell Telephone Labs., Inc., Allentown, Pa.
STUDIES ON HIGH PRECISION RESONATORS
R. A. Sykes, W. L. Smith, and W. J. Spencer *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 4–27 refs (See N65-10701 01-07)

The performance of precision crystal-controlled oscillators has led to the study of the quartz crystal units along two lines—the effects of residual gases in the device enclosures and the imperfections in the quartz itself. Previous work has shown that the initial performance of 2.5- and 5-Mc crystal units is dependent on the total gas pressure within the crystal unit enclosure and upon the gaseous composition. Additional tests on similar units lend support to this theory. The reduction of the effects due to gas adsorption indicates a second device instability that may be related to microstrains within the quartz itself. X-ray diffraction topographic studies of several samples of natural quartz indicate a wide range of crystalline imperfection. Samples of topographs of crystals are presented, and where possible, the crystalline perfection is related to device performance. X-ray diffraction topographs of acoustic modes in quartz plates are also presented. Author

N65-10706# Georgia Inst. of Tech., Atlanta
AGING CHARACTERISTICS OF QUARTZ RESONATORS WITH COMMENTS ON THE EFFECTS OF RADIATION
R. B. Belser and W. H. Hicklin *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 127–175 refs (See N65-10701 01-07)

More than three hundred AT-cut quartz resonators of 16-Mc fundamental frequency have been fabricated, stored at 85° C, and measured for frequency stability in the fundamental, third, and fifth modes over periods of 3 to 15 months. Controlled variables introduced were quartz type, plating metal, bonding cement, and mounting envelope. Accuracy of measurements was a few parts in 10^9. The better units, coated with single-layer electrodes of aluminum or gold, changed frequency < 2 parts in 10^8 per month; those coated with bimetal layers of Al + Au changed only slightly more. Resonators plated with Al + Al exhibited changes several times greater. Bilayer electrodes of all types induced greater frequency changes and greater susceptibility to frequency shifts due to inadvertent temperature cycling than did single-layer electrodes. Aging at the fundamental mode was greater and more erratic than at the third or fifth overtone modes. Variations introduced by the type of quartz (natural or cultured, swept or unswept) did not appear to be significant in the aging of the units examined. Author

N65-10712# Scientific Electronic Products, Inc., Loveland, Colo.
CRYSTAL UNITS FOR SINGLE SIDEBAND APPLICATION
Paul Bryan and E. M. Shideler *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 267–271 (See N65-10701 01-07)

Crystal units for sideband application are reviewed. Manufacturing processes and testing techniques are described as applied in the PRC-47, one of the more recently developed single sideband transceivers. Specifications for compensated crystals and the matching pairs enclosed in the HC-27/U glass holder are discussed. These types of crystal units are used in the frequency synthesis techniques to provide a materially greater channel coverage, and a much higher degree of accuracy. Author

N65-10714# Midland Mfg. Co., Inc., Kansas City, Kan.
DEVELOPMENT STATUS OF QUARTZ MICROMODULE CRYSTAL UNITS
Paul J. Staelens *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 283–288 (See N65-10701 01-07)

The general objectives of the micromodule concept are to reduce component size, increase component density by stacking wafer-mounted components, and increase reliability. The specific objective of the crystal program is to package a crystal in a wafer 0.310 in. by 0.310 in. by the minimum thickness possible. The frequency range was set at 7 Mc to 70 Mc. The progress of the micromodule program is primarily linked to the various wafer designs, the methods of mounting the crystals in these wafers, and the type of sealing methods used in obtaining a hermetic seal between wafer and cap. The progress in crystal design has been primarily the successful sealing of conventional designs for AT cuts. Most of the problems arising in the micromodule program were encountered with the various wafer designs and associated mounting techniques used with the individual wafer design. The remainder of the more troublesome problems were encountered in processing the quartz blanks and obtaining good temperature coefficient characteristics of the fundamental crystals fabricated. Plans to solve the problem of obtaining a good hermetic seal include further investigation into the point contact resistance method, the induction sealing method, and investigation of the possibility of using ultrasonics for sealing. Plans to improve crystal yield include possible use of a new Hanovia and the redesign of crystals operating on the fundamental. Work is being done to reduce handling, and the time required to process blanks.
Author

N65-10720# Bell Telephone Labs., Inc., Allentown, Pa.
PROBLEMS ASSOCIATED WITH PRECISION QUARTZ RESONATORS
W. J. Spencer *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 325–328 refs (See N65-10701 01-07)

The problems discussed are divided into three categories—quartz plate problems, problems of mounting and electrode interfaces with the quartz, and the gaseous environment of the crystal. It is indicated that the leading problem in developing precision resonators is the reduction in the total gas pressure within the device enclosure, and that the main obstacle to obtaining gas-pressure reduction is the lack of a good mounting to the quartz plate that is bakeable to high temperatures (over 500° C).
P.V.E.

N65-10726# National Co., Inc., Malden, Mass.
THE DEVELOPMENT AND PERFORMANCE OF A MINIATURIZED CESIUM BEAM TUBE
James George *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 438–448 (See N65-10701 01-07)

In the design of a double-cavity cesium-beam tube, designated the NC-17FS, factors such as vacuum lifetime, cesium gettering, cesium-beam optics efficiency, hot-wire ionization, and C-field homogeneity were significantly improved. Tube failure due to poor vacuum and excessive cesium background are now practically nonexistent. The adaptation of the cold-cathode titanium–ion pump has been successful, and tube performance indicates that an operating lifetime of 50000 hours is achievable. The use of antimony as a getter for expended cesium has proved efficient. The behavior of the static characteristics of the NC-17FS beam tube was evaluated with respect to vibration and shock; no change in operating characteristics was indicated during or after the tests.
D.S.G.

N65-10727# General Technology Corp., Torrance, Calif.
PERFORMANCE AND APPLICATION OF GAS CELL FREQUENCY STANDARDS
Donald J. Farmer *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 449–461 refs (See N65-10701 01-07)

Atomic frequency standards of the gas-cell type have been coming into increasing use since their introduction as commercial equipment. Observed performance characteristics of these devices are discussed, as well as applications in which they are being used, or are planned to be used, and experience from the standpoint of reliability.
Author

N65-10731# Bendix Corp., Detroit, Mich.
TEMPERATURE COMPENSATION OF QUARTZ CRYSTAL OSCILLATORS
Darrell E. Newell and Richard H. Bangert *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 491–507 (See N65-10701 01-07) (Contract DA-36-039-SC-90782)

As shown in a block diagram of a temperature-controlled oscillator, the three basic parts consist of the crystal, the active network, and a temperature-controlled reactance. Three methods of temperature compensation that differ in the type of controlled reactance to be used are discussed. The first method uses a "varicap" or back-biased semiconductor diode as the temperature variable reactance; the second method uses the junction capacitance of the transistor in the active network as the controlled reactance; and the third method uses a capacitor and diode combination. Other characteristics of the crystal and compensated oscillators are discussed, although they are not directly related to temperature compensation.
D.S.G.

N65-10733# Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
ACCURACY OF VHF FILTER CRYSTAL MEASUREMENTS
Arthur D. Ballato and Frank K. Priebe *In its* Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 537–565 refs (See N65-10701 01-07)

Two methods are discussed for measuring the values of equivalent circuit elements of a quartz crystal—the Schering Bridge Method, and the Substitution Method. These were selected to illustrate measurement problems in the vhf range. The substitution method is simple to use and is quite popular in general, but its accuracy diminishes rapidly with both increasing frequency and crystal resistance, and is a function of the load capacitor used. The other method is less severely limited by frequency considerations and has a greater accuracy in the vhf range, although it necessitates more equipment and greater testing time. Both methods are described in detail, and the measurement errors are discussed.
D.S.G.

N65-10734# Damon Engineering Co., Inc., Arlington, Va.
RECENT DEVELOPMENTS IN CRYSTAL FILTERS
David I. Kosowsky and Carl R. Hurtig *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 566–586 refs (See N65-10701 01-07)

Two distinct techniques of crystal-filter design are discussed—image parameter design, and insertion-loss synthesis. The latter is expected to play an ever increasing role in crystal-filter technology, principally because the modern network-synthesis technique permits design and realization in areas that cannot be handled by classical image-parameter approach. Approximation techniques and dissipative correction techniques

used in image-parameter design are described. The discussion of insertion-loss design includes insertion-loss analysis and polynomial comparison, synthesis, low-power insertion loss, time-domain filters, and contiguous comb filters. D.S.G.

N65-10735# Naval Research Lab., Washington, D.C.
FREQUENCY SYNTHESIZING TECHNIQUES PERMITTING DIRECT CONTROL AND RAPID SWITCHING
R. R. Stone, Jr. and H. F. Hastings *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 587–601 (See N65-10701 01-07)

A synthesizing system is described. A number of desirable characteristics are provided: (1) The output is directly controlled by a single input frequency and has the same frequency accuracy and stability as the input signal. (2) The output frequency is selected and switched in digital increments that can be as small as desired. (3) Switching can be accomplished at speeds in the order of one millisecond. (4) Switching of the output frequency can be readily accomplished by remote and automatic means. (5) No switching or variation of internal frequency sensitive elements is involved. (6) The system is inherently relatively free of spurious sidebands. (7) The device lends itself to modular construction in which many of the modules are identical and interchangeable. Author

N65-10736# Parzen Research, Inc., Westbury, N.Y.
MEASUREMENT OF THE INSTANTANEOUS FREQUENCY AND PHASE STABILITY OF FREQUENCY STANDARDS BY MEANS OF FREQUENCY COMPARATORS
B. Parzen *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 602–618 ref (See N65-10701 01-07)

The technique of rapidly determining the frequency and phase characteristics of precision frequency standards by means of frequency conparators is described. The types of data obtained and their forms of presentation are discussed. The usual comparator circuits are narrowband so that the data exhibit only low modulation rates. Wideband cricuits are necessary to reproduce the higher modulation rate data, and comparators with such circuits have recently been developed. The performance obtainable from the most advanced comparators now available is presented. Typical performance for comparing 1, 2.5, and 5 Mc/sec standards is better than 1 part in 10^{12} for 1-sec observation time, 1 part in 10^{11} for 0.1-sec observation time, 1 part in 10^{10} for 0.01-sec observation time, and 1 part in 10^{9} for 0.001-sec observation time. Author

N65-10782# Technical Research Group, Inc., Melville, N.Y.
DEVELOPMENT OF A LOW-NOISE MILLIMETER-WAVE PARAMETRIC AMPLIFIER Fourth Quarterly Progress Report, 1 Apr.–1 Jul. 1964
J. Kliphuis and D. Neuf [1964] 23 p
(Contract DA 36-039-AMC-2365(E))
(Rept.-4; AD-450674)

Measurements made at liquid-helium temperature on a surface-barrier varactor at frequencies between 30 and 40 Gc are presented. These measurements indicate that both the varactor and the mounting technique used are suitable for amplifier operation at 4.2° K. Tests made on the 94-Gc Faraday-type isolator also indicate satisfactory operation at liquid-helium temperatures. A prototype 35-Gc amplifier is described that incorporates a surface-barrier varactor with a self-resonant frequency of 35 Gc. Author

N65-10871# CBS Labs., Stamford, Conn.
ALL-EVAPORATED AND MASKLESS FABRICATION TECHNIQUES FOR ACTIVE DEVICES First Interim Development Report, May 28–Aug. 28, 1964
9 Sep. 1964 27 p refs
(Contract NObsr-87512)
(AD-447445)

This paper contains the literature search and the detailed planning toward the goal of a controlled deposition of epitaxial silicon films by vacuum evaporation, and the development of an ion generation focusing and deflection system for the selective doping of the silicon films. G.G.

N65-10886# Army Materials Research Agency, Watertown, Mass. Materials Engineering Div.
TUNGSTEN/TUNGSTEN–RHENIUM THERMOCOUPLES IN A CARBON ATMOSPHERE
Raymond L. Farrow and Albert P. Levitt Jul. 1964 30 p refs
(AMRA-TR-64-12; AD-606565) OTS: $0.75

In an effort to extend the useful thermocouple range to 2500° C and beyond, investigations have been conducted in the use of refractory metal wires as thermocouple legs. To determine the feasibility of employing tungsten and tungsten-rhenium alloys in selected environments, both exposed bead and preformed tantalum-sheathed thermocouples were studied. A series of thermal stability tests were conducted at temperatures up to 1400° C, as well as a very high temperature test at 2400° C. Both W-W 26% Re and W 5% Re-W 26% Re thermocouples were tested in a reduced-pressure carbon–argon atmosphere. Author

N65-10887# Litton Industries, San Carlos, Calif. Electron Tube Div.
RESEARCH ON NOISE IN CROSSED-FIELD GUNS Quarterly Report, 1 Apr.–30 Jun. 1964
R. P. Wadhwa 20 Jul. 1964 49 p refs
(Contract NObsr-89546)
(QR-4; AD-606838)

Design of a short Kino gun to be used in a low-noise crossed-field amplifier is discussed. This gun design was based upon the minimization of diocotron gain in the gun region. The design of the amplifier is briefly discussed. Measurements for gain, power, and noise figure are described. The beam characteristics can be improved by proper optimization. Results under optimized conditions and measurements on the optimization of noise figure are also discussed. Space-charge smoothing of noise figure is noticed and a minimum noise figure of 16.7 dB at S-band was measured. Author

N65-10896# Microwave Associates, Inc., Burlington, Mass.
PEM—SOLID-STATE MICROWAVE TR-ATR SWITCH Fifth Quarterly Technical Report, 18 Apr.–18 Jul. 1963
Robert H. Brunton [1963] 33 p
(Contract DA-36-039-SC-86718)
(Rept.-5; AD-422575)

The third and final group of engineering samples of a 1.0-kW solid-state X-band microwave TR–ATR switches was completed and delivered. The technical results on recovery-time investigation and diode selection specifications previously reported have resulted in superior units. The mechanical and electrical design of the switch was reviewed, and minor mechanical changes were made to reduce production costs and to generally improve electrical performance. The status of the life tests is given. D.S.G.

N65-10920# Centre de Physique Electronique et Corpusculaire, Orsay (France)
GENERATION OF INFRAMILLIMETRIC WAVES BY MEANS OF ELECTRONIC BEAMS Technical Report No. 2, 1 Oct.–Dec. 1963
[1963] 32 p
(Contract AF 61(052)-715)
(WR-1195; RADC-TDR-64-281; AD-451211)

Attempts to extend the state-of-the-art of O-type carcinotron oscillators to the generation of submillimeter waves down to 0.3 mm are reported. A laboratory model of an O-carcinotron has been mounted and operated around 0.5 mm, and a power up to 10 mW has been measured. This tube oscillates in a frequency range of 530 Gc/s up to 625 Gc/s, corresponding to a minimum wavelength of 0.48 mm. The theoretical basis and design factors for these tubes are discussed. M.P.G.

N65-10945 Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
VULNERABILITY OF SEMICONDUCTOR RECEIVER RF ELEMENTS TO SIGNAL ENVIRONMENTS
Wilbur J. Gemulla and Robert B. Wilds 5 Aug. 1963 77 p
(Contract DA-36-039-SC-87475)
(EDL-M480; AD-423544)

Quantitative data are presented on the performance of microwave semiconductor devices in various kinds of strong-signal environment. The susceptibility to interference of receivers using varactor and tunnel diode amplifiers is investigated. Spurious receiver responses, gain compression, cross modulation and frequency pulling are measured, and the observed performance is related to theory where appropriate. The results of the study are sufficiently general to provide a useful guide to the performance of similar circuits in strong-signal environments. The influence of semiconductor characteristics, circuit design, and receiver design are discussed. Author

N65-10951*# Duke U., Durham, N.C.
RESEARCH ON NON-MAGNETIC POWER SUPPLIES
John L. Artley and James E. Hall., Jr. Washington, NASA, Nov. 1964 68 p refs
(Grant NsG-251-62)
(NASA-CR-130) OTS Prices: HC $1.75/MF $0.75

This is a report describing work accomplished in the study of components for use in a nonmagnetic converter. A new oscillator utilizing 4 transistors in a bridge arrangement is reported to have a maximum efficiency near 80% when operating over a range of frequencies from 7 to 30 kc. The analysis and experimental testing of toroidal, distributed winding, air core transformers exhibit a reasonably good correlation over a range of frequencies from 10 to 100 kc. An equivalent circuit is developed, and parameters of the circuit are calculated from the size and shape of materials in the toroidal configuration. The equations and calculations involving circuit parameters and circuit response are of a complexity that requires the use of a digital computer to yield analytical results in a reasonable time. Tables and graphs present analytical and experimental results describing input impedance, efficiency, transfer function, resonant frequencies, and external magnetic fields. Author

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N65-10026# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering
AN ANALYSIS OF COMPENSATION TECHNIQUES AND SENSOR NONLINEARITIES IN A MASS EXPULSION SINGLE-AXIS SATELLITE ATTITUDE CONTROL SYSTEM
Richard G. Cronquist and David W. Welp (M.S. Thesis) Jun. 1964 91 p refs
(GGC/EE/64-6; AD-603954)

Three conventional compensators and combinations of these are analyzed, and the results presented and compared for acquisition and limit cycle operation. Based primarily on the criterion of low fuel consumption, the rate gyro compensator is best for acquisition whereas the pseudorate compensator is best for limit cycle. The effects of sensor nonlinearities are analyzed for rate and displacement gyros. The rate gyro deadzone produces the only significant effect on the system. This deadzone considerably increases the fuel consumption in the limit cycle. As an extra objective, a unique compensation technique is derived that greatly decreased fuel consumption during acquisition. Author

N65-10092# Joint Publications Research Service, Washington, D.C.
FREQUENCY FLUCTUATIONS OF AN OSCILLATOR WHEN AUTOMATIC FREQUENCY STABILIZATION CIRCUITS ARE USED
I. L. Bershteyn *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 188–203 refs (See N65-10076 01-23) OTS: $6.00

The frequency-fluctuation spectrum of an oscillator is studied when circuits are used for automatic stabilization of its frequency (AFC method and APC method). The effect of circuit parameters on the amount of reduction in the spectral density for the frequency fluctuations is considered. Author

N65-10095# Joint Publications Research Service, Washington, D.C.
LOGIC CIRCUITS BASED ON A DIODELESS CELL USING BRIDGE COUPLING
F. A. Gareyev and V. A. Popov *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 225–232 refs (See N65-10076 01-29) OTS: $6.00

The construction of the principal logic circuits is considered. The design of push-pull elements without diodes and

with a bridge coupling is discussed, and circuit stability data are given. It is stated that the use of diodeless circuits leads to considerable improvement in the reliability of digital devices. D.E.W.

N65-10102# Joint Publications Research Service, Washington, D.C.
SOME PROBLEMS IN THE THEORY OF OPERATING RELIABILITY OF A CYCLIC AUTOMATIC DEVICE
V. I. Zakharov *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 272–277 refs (See N65-10076 01-23) OTS: $6.00

A cyclic automatic device is a self-oscillating system with strong excitation. The problem considered is that of determining the probability for uninterrupted operation of an automatic device whose basic element performs reciprocating motion between two stationary supports separated by a distance. Equations are derived that make it possible to determine the multidimensional distribution law. D.E.W.

N65-10137# Joint Publications Research Service, Washington, D.C.
GENERALIZED CHARACTERISTICS OF IMPEDANCE-COUPLED MAGNETIC AMPLIFIERS
N. M. Yakovlev *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 81–91 refs (See N65-10126 01-14) OTS: $6.00

The nonlinear theory of the impedance-coupled magnetic amplifier with an active load is considered. The solution of the nonlinear equations is presented in the form of a family of curves determining the amplitude and phase characteristics of the choke. Author

N65-10138# Joint Publications Research Service, Washington, D.C.
ON THE AVERAGE FREQUENCY OF EMERGENCY OVERSHOOTS OF A CONTROLLED PROCESS
A. D. Bolychevtsev *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 92–101 refs (See N65-10126 01-14) OTS: $6.00

A statistical analysis of error control is presented. Expressions are derived for the conditional density of overshoots, and for the average frequency of emergency overshoots for any stationary process. Author

N65-10142# Joint Publications Research Service, Washington, D.C.
INVESTIGATION OF THE DYNAMICS OF SYSTEMS WITH MODULATION
V. N. Drozdov *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 124–126 refs (See N65-10126 01-14) OTS: $6.00

The possibility of the use of the Duhamel integral for the study of the dynamics of systems for the automatic regulation of alternating current is considered. This approach eliminates from consideration the carrier function, and retains the structural approach in the study of automatic control systems.
Author

N65-10150# Joint Publications Research Service, Washington, D.C.
OPERATION OF THE TRANSISTOR AS A THERMOSENSITIVE ELEMENT
I. B. Fogel'son *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 190–198 refs (See N65-10126 01-14) OTS: $6.00

The theory of the operation of the transistor as a thermally sensitive element is considered. Good correspondence between theory and experiment is shown. Means are shown for obtaining good reproducibility of the volt-ampere characteristics of various types of transistors. A table is presented of the dependence of the emitter voltage on the temperature for germanium transistors of the p-n-p type for differing load resistances. It is noted that the transistors can be used as temperature sensors in this regime for the measurement of temperature as well as for the control of temperature. Author

N65-10151# Joint Publications Research Service, Washington, D.C.
THE STATIONARY TEMPERATURE FIELD IN A MICROMODULE
R. K. Khasanov and Yu. P. Yermolayev *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 199–204 refs (See N65-10126 01-14) OTS: $6.00

Some results are presented of an experimental study of the temperature distribution in the volume of a cube that simulates a micromodule using the electrothermal analog as a basis.
Author

N65-10248# Utah U., Salt Lake City
MICROWAVE DEVICE AND PHYSICAL ELECTRONICS LABORATORY CONSOLIDATED QUARTERLY REPORT, APRIL 1–JUNE 30, 1964
30 Jun. 1964 117 p refs
(Contracts Nonr-1288(05); AF 04(693)-439; AF 33(657)-8677; DA-36-039-AMC-0237Z-(E))
(MDL-Q9; AD-605418)

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17. SUPERCONDUCTIVITY S. M. Chou and C. C. Johnson p 111–114

N65-10265# Utah U., Salt Lake City Microwave Device and Physical Electronics Lab.
ELECTROMECHANICAL WAVES ON ROTATING ELECTRON BEAMS Technical Documentary Report, Jul. 1962–Jul. 1964
C. H. Durney and C. C. Johnson Wright-Patterson AFB, Ohio, AF Avionics Lab., Sep. 1964 32 p refs
(Contract AF 33(657)-8677)
(AL-TDR-64-229; AD-607105)

A polarization-variable analysis is used to obtain the natural waves or modes on an electron beam having dc rotation. The use of polarization variables results in both a wave solution and a physical description of electron motion. Propagation characteristics and electron beam configurations for the natural modes are given. A small-signal power theorem is used to develop the kinetic power characteristics of the natural modes. It is shown that there are fast waves that are negative power carriers. An approximate analysis of space-charge waves on a beam with dc rotation is given. Author

N65-10270# California U., Los Angeles
CONTROL SYSTEMS THEORY APPLIED TO THE RE-ENTRY OF AEROSPACE VEHICLES — II Final Report, May 1963–May 1964
F. H. Kishi Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Aug. 1964 161 p refs
(Contract AF 33(657)-11477)
(FDL-TDR-64-48, Pt. I; AD-607440)

To bridge the gap between theory and practice, the reentry problem area is chosen for application to advanced control techniques. This problem area affords many separate areas where theory could be applied. Part 1 describes digital computer-controlled adaptive processes that can be employed for the flight path control problem, i.e., control of a vehicle about a predetermined trajectory (optimal or otherwise). In part 2, optimal reentry trajectories are determined. Author

N65-10286# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
QUALITATIVE ANALYSIS OF ONE SYSTEM OF DIFFERENTIAL EQUATIONS PERTAINING TO CONTROL THEORY
N. N. Serebryakova 30 Sep. 1964 26 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan. i Mashinostr. (Moscow), no. 5, 1963 p 29–41
(FTD-TT-64-417/1+2+4; AD-607114)

A system for stabilizing the rate of rotation of the shaft of a dc electric motor using a clock regulator with an oscillating balance-spiral system and a contact equalizing device is considered. Piecewise linear differential equations describing this system are investigated by the method of point transformation, and all possible regimes of its operation are found. Author

N65-10371# Boeing Co., Seattle, Wash. Aero-Space Div.
MANUAL FOR CIRCUIT ANALYSIS AND DESIGN—TREE, VOLUME I
Kirtland AFB, N. Mex., AF Weapons Lab., Jul. 1964 139 p refs
(Contract AF 29(601)-6014)
(WL-TDR-64-60, Vol. I; AD-447151)

Volume I outlines the procedures necessary for making both rapid estimates and detailed predictions of a circuit's response; examples are given for each method, and results, including experimental comparisons, are shown for 20 circuits and systems. Logic, linear, and nonlinear circuits are included. Computer techniques are presented that contribute to a more rapid solution of the equations necessary for solving the charge-control radiation equivalent circuit behavior. The philosophy of circuit and system hardening is discussed, and specific suggestions are given for improving component selection and circuit design. Procedures for correlating results of measurements and predictions in different nuclear-radiation environments are discussed, and dosimetry techniques are presented for X-ray, gamma ray, electron, and neutron sources. Author

N65-10426# McDonnell Aircraft Corp., St. Louis, Mo.
NUCLEAR EFFECTS PREDICTION TECHNIQUES FOR TELEMETRY Final Report
T. J. Klingen, S. K. Misra, B. J. Stralser, and D. J. Welling Wright-Patterson AFB, Ohio, AF Avionics Lab., May 1964 95 p refs
(Contract AF 33(657)-11533)
(A810; AL-TDR-64-112) OTS: $4.00

A literature survey was performed to study various nuclear-effects prediction techniques. Circuit equations and a mathematical model were developed that are used to predict the response of a simple circuit during and after irradiation when exposed to nuclear radiation. If desired, a digital computer may be used as an aid in solutions. The approach uses circuital analysis rather than component analysis. An experimental program is outlined that is intended to verify the prediction techniques involved. Author

N65-10443# Army Missile Command, Huntsville, Ala. Electromagnetics Lab.
INSTANTANEOUS SMITH CHART PRESENTATION OF IMPEDANCE ON AN OSCILLOSCOPE OR X-Y RECORDER
W. Gary Briscoe 22 Sep. 1964 23 p refs
(RE-TR-64-16; AD-450392)

A method is described for obtaining a plot of impedance on a Smith Chart as frequency or other factors in a circuit are varied. Two probes in a slotted line extract the basic data, which are operated upon to yield the real and imaginary components of the reflection coefficient. The results of measurements made at 1000, 400, and 123 Mc are given. Author

N65-10452# California U., Berkeley Electronics Research Lab.
JOINT SERVICES ELECTRONICS PROGRAM Final Report, Feb. 15, 1963–Feb. 14, 1964
D. O. Pederson and J. R. Whinnery 1 Jul. 1964 47 p refs *Its* Rept.-64-12
(Grant AF-AFOSR-139-63)
(AFOSR-64-0900; AD-603736)

This report on the joint services electronics program discusses the following topics: "Bioelectrons"—the electrophysiological properties of the nervous system, and hydration studies, including the dielectric constant measurements of xenon–hemoglobin association compounds; "Circuit Theory"—a passive network synthesis, active circuits, and time-varying networks; "Electron Streams and Interactions"—microwave amplifiers, noise and instabilities, emission, and trajectories; "Plasmas"—magnetic mirror compression, homopolar rotating plasmas, and low-energy plasmas; "Radiation and Propagation"—electromagnetic scattering from conductor loops, microwave scatter from a rough surface, dual reflectivity on synthesis techniques, surface waves, and frequency-independent antenna

studies; "Solid State Electronics"—integrated circuits, materials, and mechanisms; and "Systems"—control systems, discrete and finite-state systems, and communications systems. G.G.

N65-10615# New Hampshire U., Durham Graduate School
DESIGN OF DC-DC CONVERTERS FOR HIGH EFFICIENCY AT LOW POWER
John A. Higgins (M.S. Thesis) Jun. 1964 58 p refs
(Contract AF 19(628)-2352)
(AD-443899)

This is a study of voltage conversion by a voltage-level changer that consists of a square-wave oscillator, a transformer, and a rectifier-filter combination. The converter operates as a voltage-stepdown device, providing low output power at high efficiency. Its application in balloon flights and in orbiting satellites is considered. G.G.

N65-10654# Stanford U., Calif. Stanford Linear Accelerator Center
ON THE THEORY OF IGNITRON BREAKDOWN IN MODULATOR SERVICE
J. J. Cole and J. J. Muray Jul. 1964 66 p refs
(Contract AT(04-3)-400)
(SLAC-31)

An analysis of ignitron breakdown processes in the pulser of the beam-switching magnet that will be used to deflect the 25-GeV electron beam of the Stanford 2-mile linear accelerator is presented. Among the conclusions are these: (1) A pressure buildup is possible in the ignitron tube at high repetition-rate operation that might cause the observed forward breakdown. (2) Tubes with a built-in baffle break down easier than tubes without a baffle because of the transient pressure buildup. (3) The forward breakdown can occur with decreasing probability 1 to 10 msec after the conduction cycle. (4) Repetition rate and temperature are the most important factors influencing the rate of forward breakdown. (5) Deionization is controlled by the space-charge flow to the negative anode and by ambipolar diffusion to the walls. (6) Ion-current flow to the anode is the primary cause of observed arcbacks. (7) The rate of arcbacks is proportional to the decaying ion-current flow to the anode; therefore, the use of external circuit elements to minimize the ion current flowing to the anode will help to decrease the rate of arcbacks. M.P.G.

N65-10729# Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
PROGRESS AND PROBLEMS IN QUARTZ CRYSTAL CIRCUITRY AND MEASUREMENTS
Owen P. Layden *In its* Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 464–481 refs (See N65-10701 01-07)

This paper covers the latest progress in quartz crystal circuitry and quartz crystal measurement. The problems that exist in these areas are covered, principally, crystal oscillators and ovens and crystal impedance meters. Frequency control is divided into two broad categories—normal precision and moderate precision. Normal precision applies to those cases where the frequency stability is 10 ppm or less. Also, in this category, a precision of measurement of 1 ppm for crystal measurement is chosen. Moderate precision control then applies to those cases where a frequency stability of better than 10 ppm is needed and where a precision of crystal measurement of better than 1 ppm is necessary. This paper includes a discussion of means of obtaining this frequency stability by use of temperature control and/or temperature compensation, and also covers the work now going on in crystal measurement techniques to obtain the necessary precision of measurement of better than 1 ppm. Author

N65-10730# National Co., Inc., Malden, Mass.
PROBLEMS OF FREQUENCY MULTIPLICATION IN ATOMIC STANDARDS
H. D. Guy *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 482-490 (See N65-10701 01-07)

The general problem of generating two different frequencies, which are not simply related to one another, is examined. Methods for generating these frequencies are discussed with examples taken from the history of Atomichron development. The properties of an rf multiplier meeting the requirements of user organizations for operational frequency standards are listed. Author

N65-10732# Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
THEORY OF OSCILLATOR DESIGN
Erich Hafner *In its* Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 508–536 refs (See N65-10701 01-07)

Discussed is an approach to the design of oscillators that circumvents, to a large measure, the extreme complexity of the analytical expressions usually encountered. By representing the network impedances in polar form, it is possible to avoid approximations in the early stages of the development and, thus, to demonstrate the interrelations between the various elements in general terms. The cardinal rule here is to represent the impedances between the network nodes in general terms and to introduce their resistive and reactive components only after a clear qualitative picture of their respective roles has been obtained. The detailed discussions are restricted principally to those oscillators that have the crystal unit in the top section of the network. Although this covers a large class of circuits, it is, admittedly, a configuration that is most easily analyzed by this technique. D.S.G.

N65-10869# Lincoln Lab., Mass. Inst. of Tech., Lexington
LIMITATIONS OF OXIDE-CATHODE HIGH CURRENT DENSITY OPERATION Technical Report No. 356
H. A. Pike 22 May 1964 21 p refs
(Contract AF 19(628)-500)
(ESD-TDR-64-332; AD-604890) OTS: $2.00

Microsecond pulsed current from a good oxide cathode at normal operating temperatures is often limited by sparking rather than by saturation of cathode emission. Measurements have been made of the current at which sparking occurs for pulse lengths between 0.5μsec and 500μsec. Also, the fast time response of photomultiplier tubes sensitive in the near infrared has allowed the measurement of temperature transients on the cathode surface during and after the pulse. The current that caused a fixed-cathode surface-temperature rise was dependent upon pulse length, as was the sparking current. Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N65-10001# General American Transportation Corp., Niles, Ill.
NATURAL VENTILATION OF UNDERGROUND SHELTERS, MARCH 1962–MARCH 1964

G. J. Ducar and G. Engholm Mar. 1964 106 p refs
(Contract OCD-OS-62-114)
(GATC-MRD-1194; AD-444922)

Natural ventilation rates for an underground shelter were determined experimentally and analytically as functions of outside and shelter air temperature and humidity, stack height and insulation, ventilator cap design, and wind velocity. The increased ventilation rate resulting when a gasoline lantern is used to heat the exhaust air was also evaluated. A method is presented for predicting natural ventilation rates as a function of ambient and shelter conditions. The results indicate that natural ventilation is not a dependable method of obtaining sufficient ventilation for underground shelters during warm weather. Author

N65-10196# Oklahoma State U., Stillwater Fluid Power Controls Lab.
DECONTAMINATION OF HYDRAULIC FLUIDS Technical Documentary Report, 27 Dec. 1962–27 Dec. 1963
Wright-Patterson AFB, Ohio. Res. and Technol. Div., Jun. 1964 139 p refs
(Contract AF 33(657)-9958)
(RTD-TDR-63-4262; AD-603702)

This report includes a description of the design, development, and application of miniature hydroclone prototypes for decontaminating hydraulic fluid in ground support equipment. The hydroclone is defined, described, and explained in a manner appropriate for an introductory treatise. The specialized equipment acquired or constructed for implementation of the Hydroclone Project is delineated, as are its applications to the hydroclone study. The comprehensive investigation to determine the parameters for an optimum hydroclone for MIL-F-5606 hydraulic fluid is related, and the final values of these parameters that comprise the prototype hydroclone for MIL-F-5606 are given. A unique method for endurance testing of materials for hydroclone fabrication is portrayed, and the findings of these tests are reported. Author

N65-10272# Southwest Research Inst., San Antonio, Tex.
INVESTIGATION OF FRICTION, WEAR, AND FAILURE IN AEROSPACE BEARINGS Technical Documentary Report, 1 Feb. 1963–15 May 1964
H. E. Staph, W. A. Gunkel, G. F. Munsch, P. M. Ku, and G. Damewood Wright-Patterson AFB, Ohio. AF Flight Dyn. Lab., Sep. 1964 53 p refs
(Contract AF 33(657)-10499)
(FDL-TDR-64-88; AD-607513)

The design and construction of a facility for testing aerospace bearings are described. This facility has a target capability of vacuums to 10^{-9} torr, bearing temperatures up to 1500° F, and speeds to 24 000 rpm. The instrumentation provides for the measurement of inner and outer race temperature, cage temperature, ball temperature, cage strain, and gross slip of the ball and cage unit. The bulk of the measurements are achieved through the use of a "cage follower," a platform that rotates in synchrony with the cage, allowing cage mounted transducer leads to be brought out to signal commutating systems. The cage follower has been operated in the vacuum chamber with air environment satisfactorily. A study of aerospace bearing test failures indicates that the cage is the most critical part of the bearing and its fracture is quite often the reason for a test termination. Author

N65-10297# Hawker Siddeley Canada, Ltd., Toronto
GEMINI 1-TON, AMPHIBIOUS, OFF-HIGHWAY, AIR-TRANSPORTABLE VEHICLE: CONCEPT EVALUATION PROGRAM Final Report
F. P. Mitchell et al Ft. Eustis, Va., Army Transportation Res. Command, Jul. 1964 118 p refs Prepared for Canadian Commerical Corp.
(Contract DA-44-177-AMC-21(T))
(TRECOM-TR-64-34; AD-607345)

As the main objective of the program was to demonstrate mobility in low bearing terrain, the test vehicle was a wheeled platform, lacking steering and other essential features of the final version. The test platform was subjected to tests in prepared clay beds of low cone index and also in FI-type muskeg impassable to normal wheeled vehicles. In addition, tests were made on a level, hard surface to measure air-cushion lift as a function of height. The clay and muskeg testing demonstrated that air-cushion assistance can make mobility possible under conditions that would immobilize conventional wheeled vehicles. The hard surface tests gave results that indicated reasonably good agreement with accepted air-cushion theory. Author

N65-10346# Tyco Labs., Inc., Waltham, Mass.
POWER DENSE THERMOELECTRIC MODULE. PHASE IV: SOLIDIFICATION OF THERMOELECTRIC MATERIALS UNDER THE INFLUENCE OF ULTRASONIC AGITATION Progress Report, Period Ending 30 Jun. 1963
Martin Weinstein and A. I. Mlavsky [1963] 19 p
(Contract NObs-86015)
(PR-1; AD-422759)

An ultrasonic agitator, capable of introducing up to 250 watts of power to the solidifying interface of a melt at 900° C or above was designed and constructed. The equipment that utilizes a piezoelectric transducer has been used to determine the effect of frequency, amplitude, and rate of solidification on the crystallization of N-type PbTe. Details of the experimental equipment are given along with an account of the results obtained for N-type PbTe. Author

N65-10392# Illinois U., Urbana Electrical Engineering Research Lab.
A 35 GIGACYCLE BUNCHING ACCELERATOR FOR ELECTRONS
William E. Kunz Wright-Patterson AFB, Ohio, AF Avionics Lab., Sep. 1964 135 p refs
(Contract AF 33(657)-10224)
(AL-TDR-64-214; AD-607132)

A 35-Gc linear bunching accelerator that has a nonuniform, disk-loaded waveguide as an accelerating structure is described. An accelerator that theoretically requires 75 kW of pulsed 35-Gc microwave power to accelerate a 20-mA beam to a velocity of 0.776 c has been designed and constructed. The attenuation of and the power flow in the nonuniform structure are analyzed. Fabrication techniques for construction of the disk-loaded waveguide are described. The measured output velocity of the electrons is within one percent of the theoretical value. Author

N65-10437# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
RESEARCH AND EXPERIMENTATION ON SPACE APPLICATIONS OF MILLIMETER WAVES Semiannual Technical Report, 1 Jul.–31 Dec. 1963
H. E. King 1 Oct. 1964 106 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-109; TDR-269(4250-41)-3; AD-450113)

The planning, engineering, and installation phases of the Space Radio Systems Facility (SRSF) have been concluded. The facility is established for research and experimentation on space applications of millimeter waves. The SRSF consists

of a 15-ft antenna with its associated servocontrol system, digital data processing equipment, and radiometer and receiving equipment. A brief description of the instrumentation is given; observations made to date and future plans are outlined. Observations at 3.2-mm wavelength (94 Gc) include the lunar eclipse of December 30, 1963, radiometric maps of the Moon, measurements of the Sun and Venus, and atmospheric measurements. Author

N65-10575# ARO, Inc., Arnold Air Force Station, Tenn.
TRANSONIC BLOCKAGE INVESTIGATION OF A PROPOSED DYNAMIC WIND TUNNEL MOUNT (MODEL FLY PROGRAM, USAF)
R. I. Lowndes Arnold Eng. Develop. Center, Aug. 1964 36 p refs
(Contract AF 40(600)-1000)
(AEDC-TDR-64-173; AD-604655)

The investigation was performed from Mach 0.60 to 1.50. The results are presented in terms of test section wall suction required to establish Mach number and static pressure distributions in the vicinity of the model. A maximum effective model blockage of approximately 4% occurred at Mach 1.00 to 1.10. Wall suction requirements were apparently within the maximum suction capabilities available for the tunnel. No severe pressure disturbances were measured in the proposed model location. Author

N65-10594# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium)
DESCRIPTION OF VKIFD R-2 HIGH SPEED COMPRESSOR FACILITY
J. Chauvin, F. Breugelmans, and M. Thiry Feb. 1964 42 p Appendices to TM-17
(Grant AF-63-84)
(VKI-IN-5; TM-17, Append.)

This report completes the information on the R-2 high-speed-rotor test facility of the T.C.E.A. Turbomachinery Laboratory. It covers such details as electrical circuits for the auxiliary systems and for the instrumentation, as well as some handling instruction. Author

N65-10617# Naval Weapons Lab., Dahlgren, Va. Weapons Development and Evaluation Lab.
EVALUATION AND IMPROVEMENT OF BLOW-OUT PIPE SYSTEM FOR MST CHECKOUT OF TERRIER MISSILE SUSTAINER MARK 30 ABOARD DLG 26 CLASS MISSILE SHIPS
R. H. Quillin 6 Jan. 1964 45 p refs
(NWL-1899; AD-423313)

Three tests were conducted during the evaluation: an initial blowout pipe test of the present system using the MARK 30 sustainer, and two subsequent tests using a MARK 7 and a MARK 30 sustainer conducted to evaluate a blowout pipe cooling system added to the motor–to–pipe adapter. The results of the initial test indicated that extensive damage to the pipe and checkout area could be expected as a result of the burning of a MARK 30 sustainer coupled to the present blowout pipe. Four possible approaches to a solution of this problem were considered. One of the most promising of these appeared to be the addition of a water cooling system to the present blowout pipe system. The two tests conducted using water cooling have indicated that water injected into the pipe will satisfactorily reduce pipe temperatures to safe levels during sustainer burning. Author

N65-10627*# Northrop Space Labs., Huntsville, Ala. Space Systems Section
APOLLO LOGISTICS SUPPORT SYSTEMS MOLAB STUDIES TASK ORDER N-34. POWER SYSTEM CONCEPTUAL DESIGN
R. L. Breazeale and C. O. De Long Oct. 1964 50 p refs
(Contract NAS8-11096)
(NASA-CR-61012) OTS Prices: HC $2.00/MF $0.50

A conceptual design of the electric power system is evolved for the Lunar Mobile Laboratory. Functional block diagrams of appropriate subsystems are developed, and pertinent design data are presented. Packaging concepts of the electric power system components on the MOLAB VII vehicle are investigated. Author

N65-10667# Boeing Co., Seattle, Wash.
EQUIPMENT LIST-X—20A CRYOGENIC SUPPLY TANKAGE AND SERVICING EQUIPMENT
E. L. Bangsund [1964] 32 p refs
(Contract AF 33(615)-1897)
(D2-81270; AD-450017)

This document lists the equipment assemblies fabricated, their spare parts, special tools used for normal maintenance and operation, and associated cryogenic contract residue. Author

N65-10687*# Martin Co., Baltimore, Md.
SATURN S-1C HIGH PRESSURE HELIUM STORAGE BOTTLES Final Design Report
R. A. Hirsch Jun. 1964 31 p refs
(Contract NAS8-5151)
(NASA-CR-59452; ER-13559) OTS Prices: HC $2.00/MF $0.50

This report evaluates the material properties, the qualification test results, and the stress analysis of an aluminum alloy–helium bottle design. It was found that the inherent reliability of this bottle design far exceeded the stated objectives, and it is proposed to achieve the required reliability with a smaller safety factor, which will result in a design with smaller wall thickness and less weight. G.G.

N65-10816*# Toronto U. (Canada)
PERFORMANCE STUDY OF A HIGH ENERGY MOLECULAR BEAM APPARATUS AND MEASUREMENT OF MOMENTUM ACCOMMODATION COEFFICIENTS UNDER SATELLITE CONDITIONS Semiannual Status Report, Mar. 1–Aug. 1, 1964
J. B. French [1964] 18 p refs
(Grant NsG-367)
(NASA-CR-59317) OTS Prices: HC $1.00/MF $0.50

This study describes the construction of an optical lever to make both momentum- and energy-accommodation coefficient measurements in an ultrahigh vacuum chamber. The design of a large-diameter rotating seal, utilizing indium, is presented, and an initial performance study of a skimmed beam system was made. G.G.

N65-10847# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering
FEASIBILITY OF A TRACTOR TYPE SELF-MANEUVERING UNIT
John S. Heyde, Jr. (M.S. Thesis) Aug. 1964 85 p refs
(GA/Phys/64-4; AD-605486)

A small, unstabilized, tractor-type, self-maneuvering unit (SMU) is not considered a satisfactory vehicle for extravehicular travel in space. A pendulum analogy of flight does not

prove a satisfactory method of analyzing the space-flight characteristics of an unstabilized system, because of the pilot's lack of a good reference system and thrust direction indicator. A space-flight simulator study reveals that using pitching and yawing thrust to control the main thrust vector of a stabilized SMU, the rendezvous with a target over distances up to 500 ft is a relatively simple maneuver. No reverse thrust is necessary to reduce terminal velocity because of the small velocity buildup in flight. However, when the conditions of off-center thrust are simulated by providing a constant roll rate, the percentage of hits on the target is reduced from a mean value of 90% to 17%; moreover, the terminal velocity increases to the point where retrothrust is needed to provide a safe landing. The tractor-type SMU is a very risky method of transportation requiring a very skilled operator to obtain even minimum success. Author

N65-10858# Joint Publications Research Service, Washington, D.C.
CONSTRUCTION OF LARGE UNDERGROUND FACILITIES
Vladimir Mikhaylovich Mostkov 20 Nov. 1964 352 p refs
Transl. into ENGLISH of the book "Stroitel'stuo Podzemnykh Sooruzheniy Bol'shogo Secheniya" Moscow, State Sci.-Tech. Mining Lit. Publ. House, 1963 p 1–308
(JPRS-27462; TT-64-51711) OTS: $7.00

This book examines questions of the design and construction of large-cross-section underground facilities (100 square meters and larger) for different purposes (hydraulic and transport tunnels, underground plants, electric power stations, reservoirs, etc.). Author

N65-10870# Oklahoma U. Research Inst., Norman
A LOW SPEED WIND TUNNEL FOR MEASURING THE EFFECT OF WIND ON BUOYANT DIFFUSION FLAMES
J. Reed Welker and C. M. Sliepcevich 15 Sep. 1964 49 p refs
(Contract DA-18-035-AMC-116(A))
(TM-1454-4-1; AD-606045) OTS: $3.00

The purpose of the equipment described in this paper is to provide the environment necessary to study the behavior of flames from liquid pools under the influence of wind. The equipment includes a wind tunnel with supporting blower, appropriate calming section, and observation and control room; the burner trays; and a fuel delivery system. The design of the tunnel and equipment is based on information available in the literature. A short theoretical discussion is given, and some data from the literature are used to support a slight modification of a previous method of flame representation. Literature data are also used to show the possibility of correlating the expected data in a new way. The results of this new correlation are dependent upon wind properties only, and are independent of flame properties. Author

N65-10883# Midwestern Universities Research Assn., Madison, Wis.
ON THE SUITABILITY OF THE 500 MEV FFAG SYNCHROTRON AS AN INJECTOR FOR THE AGS AND ZGS
E. M. Rowe 25 Sep. 1964 15 p refs
(Contract AT(11-1)-384)
(MURA-701)

A number of schemes for injecting the beam from the FFAG into both the AGS and ZGS are described, and estimates are made for each scheme as to how well requirements of the emittance and energy spread of the FFAG beam are met. Methods discussed include these: (1) injection of a single-turn extracted stacked beam; (2) synchronous injection; and (3) injection of a stacked beam by means of resonant extraction from the FFAG. It is concluded that there appears to be no fundamental difficulty in matching the FFAG to the AGS. Matching the FFAG to the ZGS is indicated to be more difficult, but it is concluded that with reasonable relaxation of the safety factors and with some redesign, the FFAG can be used as an injector for the ZGS. P.V.E.

N65-10901# Air Proving Ground Center, Eglin AFB, Fla.
AIR PROVING GROUND CENTER SUPPORT FOR PROJECT MERCURY
Nov. 1963 63 p
(APGC-TDR-63-64; AD-423773)

The Air Proving Ground Center provided support for approximately 300 Project Mercury and associated missions from January 1961 to June 1963. These included equipment checkout tests, dynamic tracking exercises, countdown drills, network simulations, research projects, and suborbital and orbital space flights. The general mission objectives, global tracking facilities, Air Proving Ground Center support equipment, and résumés of missions are presented, with emphasis on the Air Proving Ground Center support function and missions supported by Mercury Station 17. Author

N65-10921# Rocketdyne, Canoga Park, Calif.
SERVICE LIFE ANALYSIS OF MODEL G3000 ELECTRICAL-PNEUMATIC TEST STAND S/N 340005
J. J. Griffin 30 Jan. 1964 62 p
(Contract AF 04(695)-306)
(R-5513; AD-451210)

The investigation involved a receiving inspection, leak and functional tests, disassembling the stand into components, performing component functional tests, and disassembling and inspecting the components. The soft goods and a random sample of relays were subjected to a laboratory analysis to determine if they deteriorated with time. Author

N65-10928# National Physical Lab., Teddington (Gt. Brit.) Aerodynamics Div.
THE AERODYNAMIC INVESTIGATION FOR A PROPOSED GAS TURBINE EXHAUST TOWER FOR THE FERRYBRIDGE "C" POWER STATION
D. E. Walshe May 1964 32 p refs
(NPL-AERO-1099)

The oscillatory behavior of a proposed lattice tower supporting four tubular exhaust ducts was investigated for varying steady wind forces and also for the buffeting forces set up by the turbulent wake from a nearby chimney stack. It was found that the tower would be subject to instability in steady winds, that the value for tower excitation is approximately four times that for a single cylinder in the range $0.06 < \eta_0 < 0.13$ whereas for $\eta_0 < 0.06$, the excitation is considerably less than for a single cylinder, and the addition of a three-start helical strake system to the tower ducts is effective in reducing the excitation by steady winds to more acceptable values. The buffet tests indicate that large amplitude oscillations would arise only at high wind speeds maintained for some time. M.P.G.

N65-10934# Toronto U. (Canada) Inst. for Aerospace Studies
FOURTH INTERNATIONAL SYMPOSIUM ON RAREFIED GAS DYNAMICS, TORONTO, 14–17 JULY 1964 Book of Abstracts
J. H. de Leeuw, ed. [1964] 316 p refs Symp. Sponsored by NASA, AFOSR, ONR, and UTIAS
(AD-451220)

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N65-10947# Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (W. Germany) Inst. für Flugmechanik

A REPORT ON THE COMPUTATION CENTER OF THE GERMAN INSTITUTE FOR AVIATION AND SPACE RESEARCH FOR THE YEAR 1963 [BERICHT UBER DAS RECHENZENTRUM DER DEUTSCHEN FORSCHUNGSANSTALT FUR LUFT- UND RAUMFAHRT FUR DAS JAHR 1963]

R. Ludwig Jun. 1964 53 p refs In GERMAN; ENGLISH summary

(DLR-MITT-64-03) Available from DVL, Munich: 10 DM

This is a brief description of the development of the computation center of the DFL. The different computation programs that were initiated pertain to problems in aerodynamics, structural design of aircraft, satellite trajectories, air mechanics, propulsion, and nonlinear differentiation. G.G.

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N65-10006# California U., Berkeley Inst. of Engineering Research

THE BASE FLOW PROBLEM AT VERY LOW REYNOLDS NUMBER IN THE STOKES APPROXIMATION

H. Viviand and S. A. Berger 18 Jun. 1964 62 p refs

(Contract Nonr-222(45))

(AS-64-10; AD-603669)

The general solutions of the Stokes approximate equations of motion are derived for two-dimensional and axisymmetric flows in the half-space $x > 0$, for an arbitrarily given velocity field in the plane $x = 0$. There is assumed to be no solid surface in the half-space. According to whether the velocity at infinity is zero or not, the solutions can be said to describe either jet-type or wake-type flows. Only the latter category is considered; numerical examples are worked out and properties of the base flow at very low Reynolds numbers are investigated. A recirculating flow region may exist, but the flow properties are not sensitive to this feature. Author

N65-10059# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE FINE STRUCTURE OF THE THERMAL-EMISSION SPECTRUM OF THE EARTH'S ATMOSPHERE

K. Ya. Kondrat'yev and Yu. M. Timofeyev *In its* Cosmic Res., Vol. 2, No. 4, 1964 11 Sep. 1964 p 154-164 refs (See N65-10051 01-30)

The difficulties encountered in studying the composition and structure of the earth's atmosphere from measured data on the spectral distribution of the outgoing radiation obtained by means of satellites are discussed. Calculations are made to determine the contours of isolated emission lines of various intensities at various heights in the atmosphere. The variation in the line contours with altitude is analyzed under the conditions of standard atmospheric layering. Phenomena of line inversion and splitting are detected. The importance of investigating the fine structure of the atmosphere's emission spectrum to solve inverse problems of atmospheric spectroscopy is indicated with reference to the samples considered. Author

N65-10061# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE DAYLIGHT LUMINESCENCE OF THE UPPER LAYERS OF THE TERRESTRIAL ATMOSPHERE IN THE 1.25 μ REGION

N. M. Gopshteyn and V. I. Kushpil' *In its* Cosmic Res., Vol. 2, No. 4, 1964 11 Sep. 1964 p 180-185 refs (See N64-10051 01-30)

This article presents the results obtained in the brightness measurement of the terrestrial atmosphere in the near infrared region of the spectrum at altitudes below 30 km. A significant increase in the brightness of the upper layers of the atmosphere was observed in the region of 1.25μ in comparison with the adjacent sections of the spectrum. The intensity of the observed luminescence is not a function of altitude and azimuth. Concepts pertaining to the possible causes of the luminescence are formulated. Author

N65-10145# Joint Publications Research Service, Washington, D.C.

THE POSITION OF THE CENTER OF PRESSURE AND THE CONDITIONS OF EQUILIBRIUM OF A BODY IN A FLUID OF NONUNIFORM DENSITY

A. B. Ryabov *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 142-149 refs (See N65-10126 01-14) OTS: $6.00

This paper considers the buoyancy of a body in a fluid of nonuniform density, derives the condition for the existence of a constant center of pressure, gives recommendations for the selection of a rational shape of an instrument float element, and presents an equation for the computation of the minimal unbalanced moment of the body. Author

N65-10214# Stanford U., Calif.

CAPILLARY HYDROSTATICS AND HYDRODYNAMICS AT LOW g

W. C. Reynolds, M. A. Saad, and H. M. Satterlee 1 Sep. 1964 106 p refs

(Grant NSF-G-20090)

(LG-3)

This report is intended to provide a background of basic information for persons engaged in the design of systems involving liquid-vapor interfaces, particularly in low g environments. Included is a basic review of capillary thermodynamics and mechanics, a summary of present knowledge relating to the configuration and stability of capillary systems, a discussion of the dimensionless parameters involved in modeling capillary systems, and an extensive reference list arranged by subject. Author

N65-10222# General Motors Corp., Santa Barbara, Calif. GM Defense Research Labs.

EFFECT OF ABLATION MATERIAL ON OBSERVABLES FROM A SLENDER CONE IN A FREE-FLIGHT RANGE

L. N. Wilson, R. A. Hayami, E. W. Evans, P. E. Robillard, and I. Liu Oct. 1964 56 p refs

(Contract DA-01-021-AMC-1359(Z); ARPA Order 347-63; Proj. Defender)

(CTN64-09; AD-450181)

The effects of the introduction of mixed seeding material into the plastic ablation ring of a tungsten-tipped conical model in a free-flight range were observed by comparisons of schlieren and spectrographic observations, wake ionization and wake scattering measurements, and optical measurements. The addition of the seeded ablation material into the flow of the clean model increased the radiation level in the vicinity of the ablation ring, the electron density levels in the near wake, and the radar scattering readings from the produced wakes. It was found that the presence of a contaminant in the wake is the cause of early transition and of the very abrupt appearance of a fully developed turbulence. G.G.

N65-10223# Naval Weapons Lab., Dahlgren, Va. Warhead and Terminal Ballistics Lab.

AN ULTRASONIC RAY TRACING PROBLEM

James P. Coughlin and Fred I. Grace 27 Aug. 1964 38 p refs (NWL-1935; AD-449821)

It is required to find the path of an ultrasonic beam projected from an ellipsoid that is moving through a fluid. For subsonic flow the velocity of the fluid is found by separating the variables in Laplace's equation in semielliptic coordinates. For supersonic flow the velocity of the fluid was found by a numerical method involving characteristics. The path of the beam was then found by a numerical integration of the ray equation as given by Milne. Author

N65-10244# Maryland U., College Park
AN EXPERIMENTAL STUDY OF THE EFFECTS OF VARIATIONS IN BOUNDARY LAYER THICKNESS AND LIP COVERAGE ON THE PERFORMANCE OF FLUSH SCOOPS
Clifford L. Sayre, Jr. Jun. 1964 39 p refs
(Contract Nonr-595(18))
(AD-604354)

Two families of scoops were tested in various boundary-layer conditions. One family was based on a flush scoop with a circular inlet pipe and the other on a square inlet pipe. Each family of scoops was obtained by adding lips to the basic configuration. All lips had the same height but represented varying amounts of coverage over the inlet opening. The maximum pressure coefficient and the useful range of flow coefficients decreased with increasing boundary-layer thickness. Increasing the coverage improved the maximum pressure coefficient but decreased the useful range of flow coefficients. The family based on the circular inlet pipe proved to be generally superior to the family based on the square inlet pipe. The flush scoop with the circular inlet pipe was more sensitive to variations in free-stream velocity and gave variable performance. Author

N65-10263# Stevens Inst. of Tech., Hoboken, N.J. Davidson Lab.
ESTIMATION OF STABILITY DERIVATIVES AND INDICES OF VARIOUS SHIP FORMS, AND COMPARISON WITH EXPERIMENTAL RESULTS
Winnifred R. Jacobs Sep. 1964 111 p refs
(Contract Nonr-263(57))
(R-1035; AD-607245)

The analytical method for estimating stability derivatives, and hence stability on course, which combines Albring's empirical modifications of simplified flow theory with low aspect-ratio wing theory, is extended to take into consideration the effects on course stability of higher aspect-ratio fins as well. The method, which had been applied in an earlier report to a family of eight hulls of 0.5 block coefficient, is tested further by application to eight Series 60 forms differing in block coefficient as well as in beam, draft, and displacement—with and without rudders; to an extreme vee modification of a Series 60 model; and to three other forms—a Mariner Class model, a destroyer, and a hopper dredge. Comparison with experimental results shows that the values of stability derivatives and indices determined by the analytical method are of the right orders of magnitude and indicate correct trends. Author

N65-10283# Princeton U., N.J. Aeronautical Engineering Lab.
INTERACTIONS BETWEEN A PARTLY-IONIZED LAMINAR SUBSONIC JET AND A COOL STAGNANT GAS
Martin P. Sherman Sep. 1964 216 p refs
(Contracts AF 33(657)-9962; Nonr-1858(31); NSF GP-579)
(Aeron. Eng. Lab. Rept.-707; AD-606288)

The laminar mixing of a high-temperature, partly ionized, subsonic argon plasma jet with a surrounding helium atmosphere was studied both experimentally and theoretically. Experimental measurements of the enthalpy, helium mole fraction, and stagnation pressure were performed with a small calorimetric probe. Assuming local thermodynamic equilibrium, which is shown to be reasonable, these measurements give the thermodynamic state of the gas and its velocity. The problem was considered theoretically, using the boundary-layer approximation, and was reduced to the solution of three nonlinear, parabolic, partial differential equations that were solved by finite-difference techniques. Author

N65-10293# Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
NONEQUILIBRIUM HYPERSONIC STAGNATION FLOW AT LOW REYNOLDS NUMBERS
G. I. Inger 3 Sep. 1964 79 p refs
(Contract AF 04(695)-269)
(TDR-269(4230-20)-10; SSD-TDR-64-118; AD-607215)

An analysis of nonequilibrium-dissociated stagnation point flow on highly cooled blunt bodies in a hypersonic stream of air or diatomic gas at low Reynolds numbers is presented. An arbitrary atom recombination rate on the surface is allowed. With the use of a continuum, thin shock-layer model for flight speeds on the order of 25 000 fps or less, the problem can be broken down into two regimes, both of which can be treated analytically with good approximation. The first is a generalized nonequilibrium vorticity-interaction flow regime where most of the significant gas phase reaction effects occur, including the transition from recombination rate to dissociation rate-controlled behavior. Author

N65-10298# Mississippi State U., State College
EFFECTS OF TRANSPIRATION THROUGH ANGLED SLOTS ON THE DEVELOPMENT OF THE TURBULENT BOUNDARY LAYER Aerophysics Research Report No. 43
Gordon Leonard Harris Ft. Eustis, Va., Army Transportation Res. Command, Sep. 1964 51 p refs
(Contract DA-44-177-AMC-892(T))
(TRECOM-TR-64-43; AD-607657)

An attempt was made to understand the nature of slot transpiration and to establish an appropriate mathematical formulation of the problem suitable for solution. The theoretical solutions were compared with experimental data obtained at flight Reynolds numbers. The experimental data indicate that the theoretical methods are capable of predicting the effect of transpiration through angled slots on the development of the momentum loss thickness of a turbulent boundary layer with the condition that separation does not occur at the downstream edge of the slot. Author

N65-10299# Mississippi State U., State College
A METHOD FOR THE CALCULATION OF THE LAMINAR AND TURBULENT BOUNDARY LAYER AROUND TWO-DIMENSIONAL AND AXI-SYMMETRIC BODIES WITH SUCTION OR BLOWING Aerophysics Research Report No. 50
Hideki Yamaoka Ft. Eustis, Va., Army Transportation Res. Command, Sep. 1964 46 p refs
(Contract DA-44-177-AMC-892(T))
(TRECOM-TR-64-44; AD-607655)

In this paper, incompressible fluid of steady flow around two-dimensional and axisymmetric bodies is assumed. The method of calculation for the laminar and turbulent boundary-layer momentum thickness with arbitrarily distributed suction or blowing is developed, starting from the energy theorem instead of the momentum theorem. By giving proper form for the suction or blowing velocity distribution, momentum thickness is expressed by the summation of two terms, one given for the impervious case and the other produced by the existence of suction or blowing velocity distribution on the surface of the body. For the evaluation of the impervious term, Truckenbrodt's method is used. As examples of the application of the method, an elliptic cylinder for a two-dimensional case and a spheroid for an axisymmetric case of fineness ratio 0.3 are used for both laminar and turbulent cases. Author

N65-10335# Oslo U., Blindern (Norway) Institute of Theoretical Astrophysics

THERMAL CONDUCTIVITY TENSORS FOR WEAKLY IONIZED AIR

Arne A. Wyller [1963] 14 p refs

The true, ordinary, and effective thermal conductivity tensors have been evaluated with the requirement that the collision frequency between electrons and neutral nitrogen molecules varies as the electron velocity squared. Generally speaking the magnetic field inhibits more effectively the thermal conduction across the field than had been anticipated on the basis of a constant collision frequency. This is particularly the case for the flow direction perpendicular both to the magnetic field and to the temperature gradient. Then order-of-magnitude differences arise between the results from the two theories.

Author

N65-10342# Douglas Aircraft Co., Inc., Santa Monica, Calif.

THE INERTIA PARAMETER IN GAS PARTICLE FLOW

Marvin Adelberg 28 Mar. 1964 6 p refs

(MSCA-444-62; TN-110-D-1-4-64)

This study presents the concept of an inertia parameter in the gas particle flow. A single particle in a gas stream is considered. The only force acting on this particle is assumed to be the fluid–mechanical drag, and is expressed in terms of a drag coefficient. An estimate for the minimum inertia parameter is obtained by equations, after the Reynolds number is defined and Newton's second law has been applied to normalize all the variables.

G.G.

N65-10366 Aeronautical Research Council (Gt. Brit.)

PRANDTL-MEYER FLOW IN A RELAXING GAS

P. A. Blythe London, Min. of Aviation, 1964 18 p refs Supersedes NPL-AERO-1056; ARC-24522

(ARC-CP-724; NPL-AERO-1056; ARC-24522) HMSO: 4s

The structure of a Prandtl–Meyer fan in a vibrationally relaxing gas is examined when the amount of vibrational energy is small. The vibrational energy distribution, both through the fan and downstream of the fan, is obtained analytically, and a criterion governing freezing within the fan is developed. It is shown that there exist two length scales, measured along the wave head, which characterize regions corresponding to near frozen and near equilibrium states, respectively.

Author

N65-10389# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

A SOLUTION FOR A BOUNDARY LAYER EQUATION

L. G. Petrosyan 29 Sep. 1964 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk Arm. SSR, Ser. Fiz.-Mat. Nauk (USSR), v. 16, no. 51 1963 p 91–98

(FTD-TT-64-559/1+2; AD-607125)

The solution of differential equations of a boundary layer is examined, when the rate of the potential flow of the outer flow is determined by $U(x) = c(x - x_a)^m$ and $dp/dx = 0$. Formulas are derived for the general solution and for flow functions and velocities. The equation of the general solution is an ordinary nonlinear differential equation of the third order. It can be evaluated at given boundary conditions by an approximate numerical method. The laminary boundary layer on a flat plate in a free-plane, parallel turbulent flow is investigated, using the general solution derived earlier, and the laminar boundary on a flat plate in a longitudinal homogeneous flow is examined.

D.E.W.

N65-10436# IIT Research Inst., Chicago, Ill.

GASEOUS RADIATION IN HYPERSONIC STAGNATION POINT FLOW Final Report

Imants Reba Jul. 1964 77 p refs

(Contract Nonr-3884(00); ARPA Order 322-62)

(AD-444094)

The problem of gaseous radiation in a hypersonic stagnation-point flow was investigated. The experiments were performed in a 3-inch-diameter buffered shock tube. The investigation covered the following phases: (1) photographic study of luminous bow-shock regions; (2) total light-radiation measurements; (3) spectral light-intensity measurements; and (4) spectrographic study of radiation species.

Author

N65-10457# Aerojet-General Corp., Downey, Calif. Research Div.

INVESTIGATION OF THE COALESCENCE OF WATER DROPS Summary Report

R. E. Brown 14 Aug. 1964 28 p refs

(Contract DA-36-039-AMC-03378(E))

(Rept.-0817-01(01)FP; AD-604747)

Laboratory studies of the coalescence of water drops after contact under conditions simulating or exaggerating those conceivably prevalent in the atmosphere and in clouds are reported. Efforts to find additives to the drops atmosphere and in clouds are reported. Efforts to find additives to the drops and to the air environment that would shorten the delay of coalescence were unsuccessful. However, the effects of ionizing radiation, drop environment, drop size, and collision velocity were investigated to evaluate the postulate that coalescence is promoted by a charge difference between the two colliding droplets. Theoretical analysis of the results qualitatively confirms the following: (1) The rate of coalescence increases directly as the square of the potential difference between the drops, under conditions in which the surface-tension pressure is negligible. (2) Coalescence time is inversely proportional to both surface tension and viscosity. (3) An increase in drop temperature enhances coalescence. (4) A sufficiently strong contact pressure or a fast relative velocity between otherwise stable drops often initiates coalescence.

M.P.G.

N65-10461# Stanford U., Calif.

A STUDY OF FLOW SEPARATION BASED ON A LINEARIZED MODEL. I: FLOW PAST A CIRCULAR CYLINDER

I-dee Chang Jul. 1964 25 p refs

(Contract DA-ARO(D)-31-124-G457)

(SUDAER-199; AROD-4248-1; AD-450809)

A theoretical investigation has been made on the effect of a magnetic field on flow separation from the surface of a two-dimensional body. The problem under consideration relates to the uniform motion of a circular cylinder in an incompressible, viscous, and electrically conducting fluid. The flow is at high Reynolds number and separates from the cylinder under normal conditions. An external magnetic field is then applied, and the shifting of the separation point under steady flow conditions is computed. The linearized Burgers–Zeilon model is used for the analysis.

Author

N65-10484# General Electric Co., Philadelphia, Pa. Space Sciences Lab.

DEPARTURES FROM THE SAHA EQUATION IN AN OPTICALLY THIN NITROGEN GAS

J. L. Kulander Sep. 1964 100 p refs Presented at the 1964 Opacity Conf., Albuquerque, N. Mex., 3–4 Sep. 1964

(R64SD62; AD-607416)

The populations of the excited and ionized states in an ionized nitrogen gas are calculated for various steady-state nonlocal thermodynamic equilibrium (NLTE) situations. The nonequilibrium conditions basically result from the low electron densities (10^{11} to 10^{18} e/cm^3) considered. A model consisting of 26 energy levels is assumed for the ions NI–NVIII. The geometrical model consists of a plane-parallel, semi-infinite, optically thin layer that is assumed to be maintained at a fixed electron temperature and is irradiated by an external Planckian field weakened by a dilution factor, W. Specific densities and temperatures for which LTE holds (for the particle occupations) in N are presented. The electrons are assumed to have a Maxwellian distribution. The populations are presented for electron temperatures, T_e, and external radiation temperatures, T_r, between $10^{4\circ}$ and $10^{6\circ}$ K for various W's. Author

N65-10485# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
AN EXACT CALCULATION OF MOMENTUM AND ENERGY EXCHANGE COLLISION INTEGRALS OVER DISPLACED MAXWELLIAN DISTRIBUTION FUNCTIONS
John M. Smith Aug. 1964 33 p refs
(Contracts AF 33(657)-8298; AF 49(638)-914)
(R64SD54; AD-607333)

This report contains the details of the exact evaluation of the momentum and energy exchange collision integrals for particles interacting through a potential that depends upon some arbitrary power of the interparticle distance and for displaced Maxwellian distribution functions possessing different temperatures and mean velocities. A discussion of the applicability of the calculation in the framework of the solution of the Boltzmann equation is presented, and the results are applied to election conduction in the presence of strong electric fields with emphasis on electron runaway. Author

N65-10494# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.
A SURVEY OF HYPERVELOCITY RANGE DATA ON WAKES
Soon H. Leong Jul. 1964 62 p refs
(Contract DA-01-021-AMC-85(Z))
(R-107; AD-607166)

A compilation of wake data obtained from hypervelocity-range experiments by various investigators is presented. Quantities of interest are wake velocity decay, electron density distribution, wake growth, and transition distance. Author

N65-10501# Naval Ordnance Test Station, China Lake, Calif. Underwater Ordnance Dept.
THE EFFECT OF PROPELLER CAVITATION ON THRUST DEDUCTION A Theoretical Examination
D. M. Nelson Sep. 1964 33 p ref
(NAVWEPS-8549; NOTS-TP-3564; AD-606967)

A simple, idealized, theoretical model is used to examine the effect of propeller cavitation on thrust deduction. This study has yielded not only a qualitative understanding of how the presence of cavitation results in a decrease in thrust deduction but also a rough quantitative estimate of the conditions that result in zero thrust deduction. Author

N65-10543# European Atomic Energy Community, Brussels (Belgium)
COMPUTATION OF THE FLOW BEHIND A CONVERGING DETONATION FRONT IN CYLINDRICAL OR SPHERICAL GEOMETRY
L. Guerri and A. Taroni (Appl. e Ric. Sci., Ltd., Milan) *In its* EURATOM'S Sci. Activities – Joint Nucl. Res. Center, Ispra Establ. 1964 22 p refs (See N65-10541 01-23) Available from the Belg. Am. Bank and Trust Co., N.Y., Account No. 22.186: 450 Belg. Fr.

The report describes a finite difference scheme of implicit type for the computation of the gas flow behind a converging cylindrical or spherical detonation front, together with the front trajectory. The scheme may also be applied to the plane case, which affords the possibility of checking with the known solution given by a simple rarefaction wave centered in the origin of the detonation. Author

N65-10612# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
DIRECT MEASUREMENT OF VELOCITY DISTRIBUTION FUNCTIONS
E. P. Muntz Aug. 1964 49 p refs
(Contract AF 49(638)-1152)
(R64SD59; AD-604252)

A method for measuring velocity-distribution functions in rarefied gas flows has been investigated. The technique is a direct determination, accurate to within 1 percent, that does not significantly disturb the flow under investigation. It is shown that accurate measurements can be made of the doppler profile of emission lines excited by an electron beam. The method depends upon the tendency of high-energy electrons to transfer relatively little momentum to the nuclei when they excite the electronic levels of gas molecules. The technique presented could be used in the study of normal shock waves and other investigations in rarefied gas-dynamics research. Author

N65-10631*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
COMPUTATION OF ELECTRON DIODE CHARACTERISTICS BY MONTE CARLO METHOD INCLUDING EFFECT OF COLLISIONS
Charles M. Goldstein [1964] 11 p refs Presented at the Thermionic Conversion Specialist Conf. of the Inst. of Elec. and Electron. Engineers, Cleveland, Ohio, 26–28 Oct. 1964
(NASA-TM-X-52070) OTS Prices: HC $1.00/MF $0.50

A consistent-field Monte Carlo method is presented for the calculation of electron (and/or ion) diode characteristics including the effect of collisions. The method is applied to two cases of electron flow through a perfect lorentzian gas—monoenergetic emission, and thermionic emission. Hard-sphere elastic collisions are assumed between electrons and neutral gas molecules. Electron density distributions, potential distributions, and current-voltage characteristics are presented for both cases. The effect of increased mean free path on the aforementioned characteristics is discussed. Author

N65-10658# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
ISOTHERMAL FLOW OF AIR THROUGH SNOW OF VARIABLE PERMEABILITY
Yin-chao Yen, Chi Tien, and James A. Bender Aug. 1964 21 p refs
(CRREL-143; AD-449422)

Snow is a permeable material, and any problem concerning heat flow and mass transfer must take into account the movement of air in the material. The circulation of air through a snow pack has been found to be effective for the cooling of undersnow structures such as those in Greenland. A simplified

model is proposed to describe the physical system. The simplifications are made on the basis of field observations as well as considerations from a mathematical point of view. The mixed boundary-value problem is solved numerically to account for the effect of variable permeability. The expression for pressure distribution is given as a function of position, and the total airflow rate is obtained in terms of operating variables. An illustrative example based on actual permeability data is given to indicate the procedures. Author

N65-10670# Purdue U., Lafayette, Ind. School of Aeronautical and Engineering Sciences
AN APPROXIMATE TREATMENT OF THE PROBLEM OF A PLATE OF FINITE LENGTH IN THE STREAM OF A RADIATING GAS
A. T. Onufriev Apr. 1964 16 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), no. 5, 1962 p 70–74
(NSF G-23170)
(A&ES-TT-6)

The problem of a flow of a radiating gas on a grid that absorbs the heat flux is considered theoretically. The influence of the ratio of the radiation path length to the dimensions of the body on the value of the heat flux to the body from the high-temperature gas that flows past that body was considered by the use of approximations for the flow past a semi-infinite plate. It was decided, by approximate solution, to take into account the influence on the heat flux of the ratio between the radiation path length and the length of the plate. It was found that this relation exerts a considerable influence on the gas-temperature distribution in the flow past the plate. G.G.

N65-10677*# General Electric Co., Philadelphia, Pa. Re-Entry Systems Dept.
APPARENT DEPARTURES FROM NEWTONIAN BEHAVIOR IN LIQUIDS CAUSED BY VISCOUS HEATING
I. J. Gruntfest *In its* Mech. of Deformation and Fracture Jul. 1964 38 p refs Presented at the 35th Ann. Meeting of the Soc. of Rheol., Pittsburgh, 26–28 Oct. 1964 (See N65-10676 01-26) OTS Prices: HC $4.00/MF $0.75

As part of a general study of the flow and deformation of materials with temperature-dependent properties, an ideal couette flow of incompressible Newtonian liquids is considered here. Equations for the time-dependent temperature and velocity distributions in the liquid are solved, numerically, for a variety of stress programs and thermal boundary conditions. The results are compared with closed form analytical solutions that can be obtained in special cases. Instabilities due to regenerative thermal feedback are shown to severely limit the range of shear rates or shear stresses for which steady flows are possible. A new instability mode for the flow with constant average velocity gradient is described. Possible relationships of the heating effect to the stability of laminar flows and cavitation in liquids are mentioned. Some apparently non-Newtonian flows can be described more simply when the deviation is attributed to heating than when it is attributed to intrinsic, non-Newtonian behavior. A thermistor circuit analog is demonstrated as an aid to the solution of the couette flow equations with thermal feedback. Author

N65-10850# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering
GAS SEPARATION IN A VORTEX
Anthony J. Zappanti (M.S. Thesis) May 1964 64 p refs
(GAW/ME/64-3; AD-604832)

The ability of a gaseous vortex to contain a foreign gas within the core was evaluated. Carbon dioxide was injected axially, from exit to entrance, into the core of a vortex created by tangential injection of air into a vortex chamber. A suction tube in the back wall of the chamber was used to obtain the mixture in the core for chemical analysis. Carbon dioxide concentration in the core was measured at varying points of injection for vortex tube diameters of 1, 1 1/2, and 2 inches. Tests were conducted for four different flow rates of the vortex. It was found that carbon dioxide concentration decreased rapidly with axial distance from the point of injection, and maximum concentration at a given point generally decreased with an increase in the ratio of airmass flow to vortex-tube diameter. Author

N65-10889# Polytechnic Inst. of Brooklyn, N.Y.
THE LAMINAR BOUNDARY LAYER WITH UNIFORM INJECTION
Paul A. Libby and Karl Chen Jun. 1964 33 p refs
(Grant AF-AFOSR-1-63)
(PIBAL-836; AD-606074)

The nonsimilar velocity distribution in a two-dimensional laminar boundary layer with uniform external stream and with either uniform suction or injection is obtained by a series expansion in terms of a mass transfer parameter. The results are compared with more accurate analyses and shown to be in good agreement for a range of values of this parameter. The solution for the velocity distribution is then employed for the calculation of the distributions of energy and of element mass fraction when there are imposed requirements for energy and mass balance at the exposed surface of a porous plate with uniform injection. Author

N65-10892# New York U., N.Y. AEC Computing and Applied Mathematics Center
NUMERICAL COMPUTATION OF HYPERSONIC FLOW PAST A TWO-DIMENSIONAL BLUNT BODY
Eva V. Swenson 15 Aug. 1964 62 p refs
(Contract AT(30-1)-1480)
(NYO-1480-1)

Given a two-dimensional blunt body in a steady supersonic flow of compressible fluid, the problem is to study the flow between the body and the detached shock wave formed in front of it. The shock shape is assumed to be analytic, and it is used as an initial line in solving a Cauchy problem for the flow and the body. Hyperbolicity of the partial differential equations of motion is achieved in the subsonic region by means of complex extension on one of the independent variables. By means of such a substitution, the first-order system of nonlinear equations in two dimensions is transformed into a symmetric hyperbolic system in three independent variables. Such an increase in the number of independent variables can be avoided if the equations are written in normal form with respect to two characteristic coordinates. Author

N65-10895# California Inst. of Tech., Pasadena
STABILITY OF HELIUM II FLOW DOWN AN INCLINED PLANE
Din-Yu Hsieh Jul. 1964 22 p refs
(Contract Nonr-220(28))
(Rept.-85-28; AD-602623)

The stability of a layer of helium II flowing down an inclined plane is investigated on the basis of the two-fluid theory. The expression of mutual friction is used in the analysis. In the limit that essentially only the normal fluid is present, the Yih–Benjamin result is recovered. A similar stability criterion holds for the limit that essentially only the super fluid is present. In general, the flow system is stable only when the fluid layer is

fairly thin. Then the system may be stable for certain intermediate compositions even when the fluid is flowing down the underside of the plane. Author

N65-10908# RAND Corp., Santa Monica, Calif.
LAMINAR COMPRESSIBLE MIXING BEHIND FINITE BASES
Paul S. Lykoudis (Purdue U.) Nov. 1963 8 p refs
(P-2828; AD-423944)

The velocity along the dividing streamline for different boundary conditions inside a base region is considered in a problem of laminar mixing at constant pressure for a fluid with a Prandtl number one, and viscosity power law $\mu \sim T^{\omega}$. This problem is extended by assuming a Blasius starting velocity profile rather than a uniform one. The velocity along the dividing streamline and the effect of the Reynolds number are determined by a simple approximation of the integral solution for the problem of laminar mixing. G.G.

N65-10917# Saarland U., Saarbrücken (W. Germany) Mathematics Inst.
THE NONSTEADY SUBSONIC FLOW THROUGH AN OSCILLATING STAGGERED CASCADE WITH SEMI-INFINITELY DEEP PROFILES, PART 2 [DIE INSTATIONARE UNTERSCHALLSTROMUNG DURCH EIN SCHWINGENDES, GESTAFFELTES GITTER MIT HALB-UNENDLICH TIEFEN PROFILEN, TEIL II]
E. Meister Porz-Wahn, DVL, Mar. 1964 83 p refs *In* GERMAN; ENGLISH summary
(Contract DA-91-591-EUC-2406)
DVL-247)

Formulas derived in part I, in a formal manner, for the velocity potential of a nonsteady subsonic flow through an oscillating staggered cascade, are two different representations of the same solution of the problem. The question of the unique solubility is investigated. A formula to calculate the lift distribution by an N fundamental period form of the cascade is stated. This report contains no numerical results. Author

N65-10935# Polytechnic Inst. of Brooklyn, N.Y.
THE EFFECT OF VARIABLE TRANSPORT PROPERTIES ON A DISSOCIATED BOUNDARY LAYER WITH SURFACE REACTION
Gerald S. Janowitz and Paul A. Libby Oct. 1963 35 p refs
(Contract AF 49(638)-217)
(PIBAL-804; AD-605593)

A study is made of the alteration in surface heat transfer and in the profiles of the flow variables associated with several descriptions of the transport properties of a dissociating gas. A boundary layer of similar type is considered; a reasonably accurate description of the viscosity, conductivity, and diffusivity of a mixture of atoms and molecules is employed, along with several approximate descriptions that have been employed in the past. Numerical examples corresponding to high-altitude hypersonic flight are considered and indicate that alterations of heat transfer of up to 60% and of the profiles of possible significance can occur depending on the description of the transport properties employed. Author

N65-10941# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PROPAGATION OF STRONG EXPLOSION IN NON-HOMOGENEOUS ATMOSPHERE
E. I. Andriankin, A. M. Kogan, A. S. Kompaneyets, and V. P. Kraynov [1962] 11 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), no. 6, 1962 p 3–7
(FTD-MT-63-228; AD-602739)

Hydrodynamic calculations for a strong explosion in a nonhomogeneous atmosphere show that after a finite period there is a shock front departure upward to infinity and that if the explosion is not too strong, a strong shock wave cannot extend down to a distance greater than 16.5 km. The speed and pressure in the extending shock wave with time are determined. Formulas of conversion for various energies and heights of explosion are given, and the regions within which these conversions are applicable are indicated. M.P.G.

N65-10944# Brown Engineering Co., Inc., Huntsville, Ala. Scientific Research Labs.
FLOW FIELD CALCULATIONS AROUND A YAWED RIGHT CIRCULAR CONE
J. L. Diven Aug. 1963 66 p refs
(R-67; AD-602905)

A FORTRAN program was written to calculate the flow field about a yawed right circular cone. The program inputs are angle-of-attack, cone half-angle, free-stream Mach number, ratio of specific heats, the number of steps to be taken around the body, and the number of steps to be taken between the body surface and the shock wave. The three velocity components, pressure, density, and nondimensional entropy at the shock wave, body surface, and intermediate points in the flow field are obtained as a function of the peripheral angle. Author

N65-10952*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REAL-GAS INVISCID NOZZLE CONTOURS FOR NITROGEN AT MACH 15, 17, AND 19 WITH TABULATED PROPERTIES FOR THE CALCULATION OF BOUNDARY-LAYER EFFECTS
Charles B. Johnson and James C. Ellison Washington, NASA, Nov. 1964 126 p refs
(NASA-TN-D-2496) OTS Prices: HC $2.75/MF $1.00

The coordinates for 12 real-gas, inviscid, axisymmetric nozzle contours for nitrogen as calculated by the method of characteristics are presented for Mach 15, 17, and 19 at stagnation temperatures of 3600°, 4200°, and 4800° R, respectively, with stagnation pressures of 204, 340, 680, and 1000 atm at each Mach number. The real-gas free-stream flow properties of Mach number, velocity, density, and temperature are given at the outer edge of the contour at each coordinate point. A comparison of the real-gas contours with ideal-gas contours at Mach 15, 17, and 19 was made. Author

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N65-10018# National Physical Lab., New Delhi (India) Radio Propagation Unit
MULTIFREQUENCY RIOMETER OBSERVATIONS AT NATIONAL PHYSICAL LABORATORY, NEW DELHI. A PRELIMINARY REPORT Scientific Report No. 15, Feb.–Dec. 1963
Y. V. Somayajulu, T. N. Ranganathan, A. K. Trehan, and R. N. Srivastava 30 May 1964 30 p refs
(RPU-S15; SR & RA-3)

The report describes some preliminary results of ionospheric absorption obtained at Delhi using two transistorized riometers operating on 20 and 30 Mc/sec. The report covers the period February 1963 to December 1963 and shows that the maximum absorption for the month of July 1963 is 1.2 dB for 20 Mc/sec and 0.6 dB for 30 Mc/sec, occurring a little past noon in both the cases. The riometers are also being used as a part of solar flare patrol. Author

N65-10033# Joint Publications Research Service, Washington, D.C.
SECOND ALL-UNION GEOTHERMIC CONFERENCE
I. M. Dvorov 23 Oct. 1964 9 p Transl. into ENGLISH from Vestn. Akad. Nauk SSR (Moscow), no. 7, Jul. 1964 p 103–106 (JPRS-27053; TT-64-51309) OTS: $1.00

Topics and results covered in the nearly 90 papers presented at the geothermy conference are reviewed briefly. Generally, the research was concerned with attempts to map the temperature rate of deep layers of the earth under different geological conditions, including study of ocean-bottom heat currents, and with attempts to appraise deep hydrothermal resources that are significant for use as thermal power sources. M.P.G.

N65-10040 Federal Aviation Agency, Washington, D.C. Systems Research & Development Service
NAS CHART OVERLAYS FOR THE SYSTEM DESIGN TEAM, SUPPLEMENT NO. 2
Richard G. Brown Jul. 1964 86 p refs
(RD-64-97)

Administrative overlays that show the various offices and related boundaries of the Federal Aviation Agency within the continental United States are presented. The various overlays show the following: (1) direction-finder sites (vhf and uhf); (2) low-frequency ranges and nondirectional beacons; (3) the RAPCON (Radar Approach Control) and RATCC (Radar Air Traffic Control Center) sites; (4) location of air-carrier district offices; (5) location of airport district offices; (6) location of area coordinators; (7) engineering and manufacturing district-offices' sites; (8) flight-inspection district offices' sites; (9) general-aviation district offices' sites; (10) regional boundaries and offices; and (11) location of systems-maintenance district offices. P.V.E.

N65-10050# Naval Research Lab., Washington, D.C.
RECENT NRL CONTRIBUTIONS TO IONOSPHERIC PHYSICS
J. C. Holmes, C. Y. Johnson, and J. M. Young *In its* Rept. on NRL Progress Apr. 1964 p 7–12 refs (See N65-10048 01-23) OTS: $1.25

Rockets instrumented with a neutral gas mass spectrometer and with positive ion mass spectrometers were flown. Results from these flights on the composition and number density of both the neutral and ionic constituents provide an explanation of ionospheric ion chemistry and ionospheric behavior. Molecular nitrogen and oxygen and atomic oxygen are the primary, neutral, upper atmospheric constituents. Photoionization of these constituents creates the initial ionospheric positive ions and electrons. Through a series of ion chemical reactions, nitric oxide and molecular and atomic oxygen ions become the major ionospheric ions. The resultant ion distribution and molecular ion–electron recombinations determine the ionosphere's characteristics. Author

N65-10117# Aberdeen Proving Ground, Md. Ballistic Research Labs.
MEASUREMENTS OF ELECTRON DENSITY FROM IGY DOVAP RECORDS
Raymond E. Prenatt and John C. Mester Jun. 1964 67 p refs
(BRL-1198; AD-451086)

Two methods for obtaining ionosphere profiles as a by-product of DOVAP tracking data are described. The trajectory comparison technique makes use of the small ionosphere-induced error in the DOVAP trajectory; the Faraday rotation technique uses the Faraday rotation of one of the DOVAP signals. Measurements of the electron content in a vertical column to the rocket altitude are possible and from these the electron density at the rocket can usually be obtained. Author

N65-10173# Air Force Cambridge Research Labs., Bedford, Mass.
THE INFRARED TELLURIC ABSORPTION SPECTRUM INTRODUCTORY REPORT
J. N. Howard and J. S. Garing *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 237–278 refs (See N65-10155 01-29)

Recent work on the infrared transmission spectrum of the atmosphere of the earth is reviewed and discussed. The principal laboratory effort has been studies of absorption bands of CO_2, H_2O, CO, CH_4, N_2O and O_3 in synthetic or simulated atmospheres, in which nitrogen or oxygen is used as the foreign gas under controlled conditions of concentration, pressure, and path length. Some recent open-air studies from balloons and high-altitude aircraft are described, and the principal techniques of estimating open-air slant-path transmission from the laboratory data are described. Author

N65-10174# Cambridge U. (Gt. Brit.) Cavendish Lab.
RADIATIVE HEATING RATES IN THE EARTH'S ATMOSPHERE
C. D. Rodgers *In* Liege U. Infrared Spectra of Astron. Bodies 1964 p 279–285 refs (See N65-10155 01-29)

The basic ideas of the Curtis method for computing atmospheric cooling rates are described together with some applications and extensions of the method. This technique is equivalent to a direct integration of the basic heating equations, but the form is such that a considerable amount of useful information is retained in addition to the actual heating rate. For each spectral interval, the heating equation is put in the form $h_{n,\Delta\nu} = \Sigma A_{nj,\Delta\nu} B_{j,\Delta\nu}$, where h_n is the heating rate at level n; Bj is the blackbody function at level j assumed constant over the interval $\Delta\nu$; A_{nj} is a matrix that depends on the mixing-ratio distribution, the spectral interval, and, to a lesser extent, the temperature distribution. Application of this method to radiosonde data is described, and a simplification of the method is proposed, together with possible expressions for increasing the accuracy of the simplification method. M.P.G.

N65-10175# Saskatchewan U., Saskatoon (Canada) Inst. of Upper Atmospheric Physics
THE TELLURIC EMISSION SPECTRUM IN THE RANGE 1 μ TO 3 mm: INTRODUCTORY REPORT
A. Vallance Jones *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 289–315 refs (See N65-10155 01-29)
(Contract AF 19(628)-2829)

A general review of the terrestrial atmospheric emission spectrum in the range 1.0μ to 3 mm is presented. The emissions are classified, according to the nature of the transitions

involved, as electronic, vibrational, or rotational states that, in general, correspond to increasing wavelengths. Each section is subdivided according to the different excitation mechanisms, and copious references to observational data are given. M.P.G.

N65-10176# Ludwig-Maximilians-Universitat, Munich (W. Germany)
ATMOSPHERIC EMISSION IN SINGLE WATER VAPOR LINES AND ITS CALCULATION BY MEANS OF RADIATION DIAGRAMS
H. J. Bolle *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 316–326 refs Sponsored by USAF Cambridge Res. Labs. (See N65-10155 01-29)

Radiation diagrams for atmospheric emission have been constructed for some single water-vapor lines in the window region. The diagrams are based upon theoretical values for integrated line absorption and line width. By comparison of calculated with measured sky emissivities, empirical integrated line absorptions can be derived. For this procedure the continuum background of sky emission must be accounted for. Continuum absorption coefficients have been obtained from measurements in narrow windows between water vapor lines from 8μ to 26μ wavelength. In the 18.5μ region the empirical integrated line absorptions came out smaller than the theoretical values, but the results so far are based on only a small number of measurements on Jungfraujoch. Author

N65-10178# Reading U. (Gt. Brit.) J. J. Thompson Physical Lab.
APPLICATION OF MULTIPLE BEAM INTERFEROMETRIC METHODS TO THE STUDY OF CO_2 EMISSION AT 15 μ
S. D. Smith and C. R. Pidgeon *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 336–349 refs Sponsored by Brit. National Comm. for Space Res. (See N65-10155 01-29)

The problem ef designing a grating spectrometer for use in satellites is discussed. The proposed design is generally as follows: The interferometer would be optically worked out of germanium. The high refractive index of germanium (4.0) as a spacer then gives a further gain in luminosity, compared with air, of a factor of 16. In order to match the CO_2 lines, the order of the interferometer is high (~420); this tends to minimize the mechanical tolerances on spacer thickness, since these depend only on the finesse and not on the order. A finesse of 16 is sufficient to give 0.1 cm^{-1} width, with spacing of 1.6 cm^{-1}, and with reasonable rejection between successive orders. Such finesse would be obtained by coating the surfaces of the germanium with quarter-wave dielectric mirrors. P.V.E.

N65-10179# Oxford U. (Gt. Brit.) Clarendon Lab.
THE DEDUCTION OF STRATOSPHERIC TEMPERATURE FROM SATELLITE OBSERVATIONS OF EMISSION BY THE 15μ CO_2 BAND
J. T. Houghton and J. H. Shaw *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 350–356 refs (See N65-10155 01-29)

The designing of suitable methods and instrumentation for making satellite observations of emission by the 15μ CO_2 band is briefly described. The observations will be used to determine the temperature structure of the atmosphere between 15 and 60 km. P.V.E.

N65-10180# California Inst. of Tech., Pasadena Div. of Geological Sciences
NEW OBSERVATIONS OF ATMOSPHERIC EMISSION AND ABSORPTION IN THE 8–14 MICRON REGION
James Westphal *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 357–361 refs *Its* Contrib. No. 1206 (See N65-10155 01-29)
(Grants NsG 56–60; NSF G-25210)

A study of the emission and extinction due to the earth's atmosphere is discussed. The determination of the absolute fluxes from objects outside the atmosphere requires knowledge of the extinction correction, and the choice between the various proposed absorption models makes as much as 20% difference in the calculated external flux. Emission data obtained with a photometer, utilizing a liquid-hydrogen cooled, mercury-doped, germanium photoconductor, is presented along with extinction data that utilized the sun as an external source and a thermocouple detector. From the temporal complexity of the emission and extinction data presented, it is suggested that it is necessary to measure the flux from the sun outside the sensible atmosphere so that a choice between the various extinction models may be made. P.V.E.

N65-10239# Pennsylvania State U., University Park
AN ESTIMATION PROCEDURE FOR FOCAL-DEPTH DETERMINATION OF SEISMIC DISTURBANCES
Stephen C. Merdler (M.S. Thesis) 8 Sep. 1964 106 p refs (Contract AF 19(628)-238; ARPA Order 292; Proj. Vela-Uniform)
(AFCRL-64-755; AD-607491)

A new data processing technique is suggested to estimate the delay time between initially up-traveling energy, which is reflected once at the earth's surface, and initially down-traveling energy on earthquake seismograms. The method uses optimum inverse filters together with a criterion that measures the simplicity of a seismic signal convolved with an inverse filter. The inverse filters are designed to extract primary energy in the presence of surface-reflected energy and random noise on the basis of a least-mean-square error criterion. Filter design is dependent on the delay time between primaries and surface-reflected events, their amplitdue ratio, and noise-to-signal power ratio. The simplicity criterion was devised on the assumption that a maximum in the concentration of normalized seismic signal energy above a minimum level indicates which filter was most correctly designed. Author

N65-10280# California Research Corp., La Habra
THEORETICAL STUDIES RELATED TO THE DETERMINATION OF SEISMIC ENERGY SOURCE DEPTH Final Report, Feb. 15, 1961–Jun. 14, 1964
T. W. Spencer, W. L. Baker, J. W. C. Sherwood, D. P. Squier, and R. D. Tooley 15 Jul. 1964 192 p refs
(Contract AF 19(604)-8344; ARPA Order 180-61; Proj. Vela-Uniform)
(AFCRL-64-750; AD-607238)

The effect of seismic source depth on Rayleigh wave spectra is examined for a dissipative half space and for an elastic layer overlying an elastic half space. In the two-layer earth model, the higher-mode amplitude spectra increase relative to the fundamental as the source approaches the base of the crust. The exact ray theory and matrix method are, in principle, devices for obtaining the response of a layered system over a limited time interval. Both methods prove to be inefficient from the standpoint of automatic computation but useful in analyzing certain general properties of the response functions in multilayered systems. Geometric theory is used to study the effects of layer thickness and range on the refracted arrival along a high-speed layer embedded in an infinite medium. When the layer is thick compared with the dominant wavelength, the refracted arrival exhibits range-limited shingling and may consist of two or more events

separated by equal time intervals, which depend only on the layer thickness. Author

N65-10281# McGill U., Montreal (Canada) Arctic Meteorology Research Group
HEAT FLUX THROUGH THE POLAR OCEAN ICE Scientific Report No. 12
E. Vowinckel Sep. 1964 23 p refs *Its* Publ. In Meteorology No. 70
(Contract AF 19(604)-7415)
(AFCRL-64-7513; AD-607277)

The results of previously calculated heat release from the water of the Polar Ocean by an independent investigation of the amount of heat conducted through the Polar Ocean ice were checked. Density and salinity of the ice were taken as constants, and it was then necessary to determine the areal extent of the ice cover and the mean temperature and temperature gradients in the ice. The contributions of the different ice thicknesses to the total ice cover had to be determined for each month. The total heat flux was then determined by a weighted average for each month. The monthly flux values, reduced to the average cm^2 of surface (made up of both ice and water), are given for various areas, and the annual flux through ice of different ages is given for the Central Polar Ocean. The flux values obtained are compared with the energy available from ocean currents (including export of ice). The correspondence is very close: The two alternatives for available energy are 8486 cal/cm^2, year, and 8986 cal/cm^2, year. The calculated heat flux was 8517 cal/cm^2, year. Author

N65-10294# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
STAR-FIELD PHOTOGRAPHY AND LASER RANGING TECHNIQUES FOR SATELLITE-BASED GEODETIC MEASUREMENTS
E. B. Mayfield and E. H. Rogers 15 Sep. 1964 35 p ref
(Contract AF 04(695)-269)
(SSD-TDR-64-145; TDR-269(4710-63)-1; AD-607137)

A method is described for obtaining cartographic and geodetic data from a manned orbital satellite. The techniques utilized are a boresight camera, which simultaneously photographs a particular point on the ground and the coaxial star field, and a laser for obtaining slant range. These, together with an accurate spacecraft ephemeris, will obtain data on angle coordinates and elevation of particular points along the orbital trace of the spacecraft with respect to a primary control station. Particular instrumental requirements are given for the star-field camera and the laser ranging device. Author

N65-10305# Joint Publications Research Service, Washington, D.C.
APPLICATION OF TRIGONOMETRIC LEVELLING IN SANDY DESERT REGIONS
A. I. Mirkin 6 Nov. 1964 6 p Transl. into ENGLISH from Geodez I. Kartograf (Moscow), no. 9, Sep. 1964 p 21–24
(JPRS-27260; TT-64-51515) OTS: $1.00

An analysis of the accuracy of the results of trigonometric leveling is discussed; errors of closure of triangles are considered; and the differences in elevation errors, when performed by trigonometric and geometric leveling, are investigated. From the results of the trigonometric leveling, the following were ascertained: (1) Divergences of direct and inverse differences of elevations, calculated according to zenith distances, in a significant majority of cases exceeded 1 m, and in a number of cases, they exceeded 2 m. (2) The measured data demonstrated that with the use of a refraction factor differing from 0.14, the convergence of the direct and inverse differences of elevation did not improve. It was also ascertained that the refraction is not constant and depends upon the conditions of the passage of the collimating ray and the time of year. P.V.E.

N65-10333# National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.
TABLES OF MEDIANS OF IONOSPHERIC DATA, MAY 1964–JUNE 1962
Sep. 1964 26 p Abstracted from CRPL-F Ser., Pt. A. Ionospheric Data

N65-10344# Canadian Armament Research and Development Establishment, Valcartier
PHOTOCHEMICAL BEHAVIOR OF THE OZONE LAYER
John Hampson Sep. 1964 286 p refs
(CARDE-TN-1627/64)

Photochemical reactions of the atmospheric oxygen during 1963 were identified, and the ozone profiles as a function of the solar zenith angle were hand computed. It was calculated that a second ozone layer may be formed at lower solar-radiation angles through scattered radiation. The value for a reaction-rate parameter for the wet ozone photolysis was developed from laboratory data, and a description of the involved photochemical processes is given. G.G.

N65-10348# Joint Publications Research Service, Washington, D.C.
PROJECT "UPPER MANTLE" AND ITS INFLUENCE ON THE DEVELOPMENT OF THE EARTH'S CRUST
V. V. Belousov and B. I. Silkin 17 Nov. 1964 10 p Transl. into ENGLISH from Vestn. Akad. Nauk. SSSR (Moscow), no. 8, Aug. 1964 p 84–88
(JPRS-27399; TT-64-51655) OTS: $1.00

This is an overall report on the studies of the structure of the earth's crust. Emphasis is placed on the international project "Upper Mantle and Its Influence on the Development of the Earth's Crust." Some measurements of the magnitude of the heat flux emanating from the interior of our planet were gained. It was concluded that the responsible factors for the processes occurring in the upper part of the earth's crust are hidden in layers beginning approximately at a depth of several tens of kilometers and extending to 900 km from the earth's surface. G.G.

N65-10431# Defence Research Board, Ottawa (Canada) Directorate of Scientific Information Services
ROTATION OF THE EARTH AND CIRCULATION OF THE ATMOSPHERE
May 1963 3 p Transl. into ENGLISH from Priroda (Moscow), no. 2, 1963 p 116
(T-392-R; AD-423786)

This is a discussion of a hypothesis that explains the causes of the rotational changes in the earth's atmospheric circulation. The earth's atmospheric envelope is regarded as a figure of relative equilibrium that reacts swiftly to the pulsations in the earth's rotational velocity. When this equilibrium is deformed, a system of wind develops in order to maintain the stability of the atmospheroid. G.G.

N65-10479# RAND Corp., Santa Monica, Calif.
LOW-FREQUENCY HYDROMAGNETIC WAVES IN THE IONOSPHERE
Carl Greifinger and Phyllis Greifinger Oct. 1964 48 p refs
(RM-4225; AD-607253)

The propagation through the ionosphere of low-frequency (~1 cps) hydromagnetic waves is studied. The case of plane wave

propagation in the vertical direction, in the presence of a uniform magnetic field that is also in the vertical direction (so-called polar propagation) is considered. The purpose is to separate the effects of the ionosphere on hydromagnetic disturbances propagating through it. The ionosphere is assumed to extend infinitely far in the upward direction and to terminate abruptly 80 km above a perfectly conducting flat earth. The charged particle density is assumed to be constant throughout the ionosphere, and the neutral particle density to vary exponentially with altitude. The coupled hydrodynamic and electromagnetic equations for the medium are linearized, and, with the approximations valid for low-frequency waves, the resulting system is shown to reduce to a second-order wave equation. A solution of this equation is obtained for a disturbance that is initially localized high in the ionosphere. Author

N65-10498# Naval Research Lab., Washington, D.C. Chemistry Div.
SUMMARY REPORT ON FISSION PRODUCT RADIOACTIVITY IN THE AIR ALONG THE 80th MERIDIAN (WEST), 1957–1962
L. B. Lockhart, Jr., R. L. Patterson, Jr., A. W. Saunders, Jr., and R. W. Black 15 Jun. 1964 29 p ref
(Contract AT(49-7)-13)
(NRL-6104; AD-604338)

The current report summarizes measurements of both gross β activity and Sr^{90} activity in the air at ground level along the 80th meridian during the period 1957 through 1962. More detailed results and interpretations are given for the collections of radioactivity made in 1962. Practically all of the gross β activity encountered in the air of the Northern Hemisphere during the early part of 1962, and 80% to 90% of the Sr^{90} activity resulted from debris produced in the U.S.S.R. series of tests held in the fall of 1961. Beginning in the later summer, a second large increment of fresh activity, primarily from the U.S.S.R. tests (August–December 1962), intruded into the air at most of the sites. In the Southern Hemisphere, the source of the Sr^{90} activity was primarily premoratorium bomb debris from a stratospheric source until the initiation of testing by the United States at Christmas Island. From May throughout the remainder of 1962, these tests contributed the bulk of the Sr^{90}, except in the southernmost areas of Chile where there was a gradual rise in the contribution of the fresh component. Author

N65-10502# Stanford U., Calif. Radioscience Lab.
WAVE PARTICLE GYRORESONANCE INTERACTIONS IN THE EARTH'S OUTER IONOSPHERE
T. F. Bell May 1964 206 p refs
(Contract AF 49(638)-1060; Grant AF-AFOSR-62-370)
(SEL-64-063; TR-3412-5; AD-607379)

Two problems are considered. The first problem involves the stability of the outer ionosphere plasma to whistler-mode waves under conditions in which high energy electron fluxes permeate this plasma. A study of the stability of this plasma configuration is carried out and the sufficiency conditions for wave growth are derived as well as the wave growth rates. The second problem involves the feasibility of the creation or depletion of an artificial radiation belt utilizing the geocyclotron gyroresonance interaction in order to transfer energy between manmade waves and relativistic electrons trapped in the outer ionosphere by the earth's magnetic field near the magnetic equatorial plane. A study of the phase stability of this interaction is carried out, and the transmitter frequency–time function that optimizes the energy transfer between the VLF wave and the relativistic particles is deduced. Author

N65-10506# Norwegian Defence Research Establishment, Kjeller
LONG RANGE PROPAGATION STUDIES Summary Report
K. Folkestad 8 May 1964 38 p refs
(Contract AF 61(052)-610)
(E-31; AFCRL-64-507; AD-603088)

This report reviews the activity associated with the Step Frequency Oblique Sounder at Andoya in northern Norway during the 1-year period commencing March 1963. Pertinent experimental data are given. The results from some theoretical deductions, performed to support the process of interpretation, are presented. A set of selected examples from the collection of data serves to illustrate characteristic features pertaining to the observations. One of the chapters deals with the communication aspect of the experiment. Plans for the future are stated. Author

N65-10526*# Massachusetts Inst. of Tech., Cambridge
PHYSICAL AND CHEMICAL STUDIES OF TEKTITES
W. H. Pinson, Jr. and C. C. Schnetzler 5 Nov. 1963 72 p refs
(Grant NsG-222-61)
(NASA-CR-58865) OTS Prices: HC $3.00/MF $0.75

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N65-10527*# Massachusetts Inst. of Tech., Cambridge
VARIATION OF STRONTIUM ISOTOPES IN TEKTITES Age Studies No. 39
C. C. Schnetzler and W. H. Pinson, Jr. *In its* Phys. and Chem. Studies of Tektites 5 Nov. 1963 39 p refs Submitted for Publication (See N65-10526 01-13) OTS Prices: HC $3.00/MF $0.75

The rubidium, strontium, and strontium isotopic compositions have been determined in tektites from Indochina, Philippine Islands, Java, Australia, Texas, Georgia, Massachusetts, and Czechoslovakia. The range of Sr^{87}/Sr^{86} ratios in 18 tektites is from 0.7121 to 0.7223, indicating the results of Pinson et al. (1958), reporting no radiogenic strontium in tektites, were not of sufficient precision to study the problem definitively. This range of Sr^{87}/Sr^{86} ratios is quite small compared to the range found in nature, in general agreement with previous studies of oxygen and silicon isotopes in tektites. Rb and Sr contents of tektites from a given locality are very similar, but differences exist between localities. There is indicated, however, a sympathetic variation of the Sr^{87}/Sr^{86} and Rb/Sr ratios; i.e., the tektite groups have age values of approximately 400 m.y. Author

N65-10528*# Massachusetts Inst. of Tech., Cambridge
A REPORT ON SOME RECENT MAJOR ELEMENT ANALYSIS OF TEKTITES
C. C. Schnetzler and W. H. Pinson, Jr. *In its* Phys. and Chem. Studies of Tektites 5 Nov. 1963 28 p refs Submitted for Publication (See N65-10526 01-13) OTS Prices: HC $3.00/MF $0.75

Forty-two tektites and two amerikanites were partially or completely analyzed for major elements. Included were 7 moldavites, 1 bediasite, 2 javanites, 15 philippinites, 12 indochinites, and 5 australites. Many chemical similarities are noted between the phillippinites and indochinites, but the two

groups appear different in SiO_2, Al_2O_3, TiO_2 and, in particular, CaO contents. No decrease in alkali element content is observed from Indochina to the Philippine Islands (i.e., west to east), as is observed across Australia. Real variations, up to approximately 10% for some constituents, exist within the philippinites and indochinites, and even within tektites from restricted sites. Tektites from two sites in the Philippine Islands are identical, within experimental error, in mean composition. The unity of chemical character of the australites and the southeast Asian tektites strongly suggests that they represent one large strewn field. Author

N65-10592# Advisory Group for Aeronautical Research and Development, Paris (France)

ARCTIC COMMUNICATIONS. PROCEEDINGS OF THE EIGHTH MEETING OF THE AGARD IONOSPHERIC RESEARCH COMMITTEE, ATHENS, GREECE, JULY 1963

B. Landmark, ed. (Norwegian Defense Res. Establ., Kjeller) Oxford, N.Y., Pergamon, 1964 287 p refs

(AGARDograph-78) Available from Pergamon (Macmillan Co., N.Y.): £5

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16. BACKSCATTER OBSERVATIONS AT LINDAU-HARZ WITH VARIABLE FREQUENCY DIRECTED TO THE AURORAL ZONE H. G. Moller (Max-Planck Inst. für Ionosphärenphysik, Lindau-Harz) p 177–188

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21. VERY LOW FREQUENCY RADIO WAVE PROPAGATION AT HIGH LATITUDES Alv Egeland and Willi Riedler (Kiruna Geophys. Obs.) p 237–252 refs

22. V.H.F.-BISTATIC-AURORA COMMUNICATIONS AS A FUNCTION OF GEOMAGNETIC ACTIVITY AND MAGNETIC LATITUDE G. Lange-Hesse (Max-Planck Inst. für Ionosphärenphysik, W. Germany) p 253–262 refs

OBSERVATIONS DURING NUCLEAR TESTS

23. OBSERVATIONS MADE BY THE IONOSPHERIC INSTITUTE OF ATHENS DURING THE SERIES OF NUCLEAR WEAPON TESTS AT NOVAJA ZEMLYA BETWEEN 10 SEPTEMBER AND 4 NOVEMBER 1961 M. Anastassiades, D. Ilias, G. Moraitis, and P. Giouleas p 265–279 refs

24. OBSERVATION OF IONOSPHERIC PERTURBATIONS EXCITED BY NUCLEAR EXPLOSIONS P. Halley, F. Biraud, and A. M. Bourdila p 281–292 refs

N65-10655# Universidad Autonoma de San Luis Potosi (Mexico)

TRIANGULATION AS A BASE FOR THE PHOTOGRAMMETRIC LEVELING OF AN IRRIGATION ZONE [TRIANGULACION COMO BASE PARA EL LEVANTAMIENTO FOTOGRAMETRICO DE UNA ZONA DE RIEGO]

Raul Melendez Hernandez Oct. 1964 69 p In SPANISH

The results of a triangulation study are presented to serve as the basis for the photogrammetric leveling of a zone to be irrigated. It is found that the principal parameters of both types of study are similar, and that triangulation serves as a good base for many topographic studies. D.E.R.

N65-10657# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

GROWTH, STRUCTURE, AND STRENGTH OF SEA ICE

Andrew Assur and Wilford Frank Weeks Oct. 1964 24 p refs (CRREL-135; AD-450186)

The freezing interface primarily determines the basic characteristics of sea ice. As the platelets composing the individual crystals of salt ice grow, impurities such as salt are rejected by the ice crystals and diffuse away from the platelets. The freezing point is lowered within the diffusion cloud preventing other platelets from growing in the vicinity. As a result, the

plate width decreases with increasing growth rate. The physical constants involved are the diffusion coefficient of salt in water and the roughness of the freezing interface. In an earlier paper it was shown that plate width varied with the 6th root of the distance beneath the upper surface of the ice sheet. This corresponds to an ice growth equation with the power 3/4 in time. Past empirical equations as well as laboratory tests confirm the applicability of this power for moderately thick ice (~10 to ~40 cm). Considering that heat transfer from the ice surface is the primary factor governing growth while the ice is thin, it is shown that the power in time is 1 for thin ice and gradually changes to 1/2 for thick ice. Author

N65-10661# Ohio State U. Research Foundation, Columbus Inst. of Geodesy, Photogrammetry and Cartography
PRACTICAL METHODS FOR THE DETERMINATION OF GRAVITY ANOMALIES AT LOW ELEVATIONS Scientific Report No. 11
Mohamed F. Madkour Jun. 1964 28 p refs *Its* Rept.-No. 45
(Contract AF 19(628)-2771)
(AFCRL-64-577; AD-450947)

The author has tested most of the available methods for the upward continuation of the gravity anomaly in a previous work. In this paper, two new methods are added for low elevation—the modified statistical method and the empirical method. The two developed methods are based on the upward continuation integral. A simple template is suggested to be used with each method. The two methods were tested for elevations of 5, 10, and 15 km. Their results were compared with those obtained by using Hirvonen's template. A comparison between the standard errors of the results from different methods proves that the new methods are not only simpler than the others, but they are also more accurate. Author

N65-10669# Kakioka Magnetic Observatory (Japan)
GEOMAGNETIC AND GEOELECTRIC OBSERVATIONS, 1963 (RAPID VARIATIONS)
1964 99 p
(Rept.-4)

This paper contains the 1963 data tables of magnetic storms, magnetic sudden impulses, magnetic bays, magnetic solar-flare effects, and of the magnetic pulsations pt and pc, collected by the Kakiota Magnetic Observatory. The storm time, the factors on sudden commencement, the degree of activity, as well as the maximal activity on the K-scale and ranges, were tabulated. Some examples of rapid-run induction magnetograms and rapid-run tellurigrams are also presented. G.G.

N65-10781# Weapons Research Establishment (Australia)
IONOSPHERIC DATA FOR JANUARY 1964 FROM WOOMERA, SOUTH AUSTRALIA
May 1964 24 p
(CPD-1964/1(W))

This paper contains tabulations of ionospheric data obtained at Woomera in South Australia during January 1962. The observations are associated with upper atmosphere experiments and have been collected with the help of an ionosonde. G.G.

N65-10790# Kakioka Magnetic Observatory (Japan)
REPORT OF THE KAKIOKA MAGNETIC OBSERVATORY, GEOELECTRICITY, MEMABETSU, 1950–1956
1964 63 p
(Rept.-34)

This is a collection of observations of the atmospheric-electric potential gradient and the earth-current potential gradient during 1950 to 1956. The changes of the absolute value of the earth current were practically eliminated by a frequent removal or exchange of the measuring electrodes. Tables of the mean hourly values of the atmospheric electricity and of the diurnal variation of the earth-current potential gradient are presented together with some examples. G.G.

N65-10874 Royal Aircraft Establishment, Farnborough (Gt. Brit.)
THE DENSITY OF THE UPPER ATMOSPHERE AT HEIGHTS OF 200–230 KM [PLOTNOST' VERKHNEI ATMOSFERY NA VYSOTAKH 200–230 KM]
M. Ya. Marov London, Min. of Aviation, Mar. 1964 7 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), no. 1, 1963 p 143–146
(RAE-TRANS-1060)

Information is given on the retardation of the satellites Cosmos 3 and Cosmos 5, and estimates are made of the density of the atmosphere in the region of their perigee. Author

N65-10885# RAND Corp., Santa Monica, Calif.
LATITUDINAL VARIATION OF MESOPAUSE HEIGHT INFERRED FROM ECLIPSE OBSERVATIONS
G. F. Schilling Oct. 1964 21 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-4321-PR; AD-607171)

Observations of the flattening of the earth's shadow during lunar eclipses are used to compute the magnitude of a latitudinal height variation of the shadow-producing level. By means of a postulate that this level is associated with a temperature minimum in the earth's upper atmosphere, a latitudinal variation is inferred for the mesopause, with the equatorial height being about 25 km greater than the height over the poles. Further inferences lead to the conclusion that a double mesopause may be a consistent feature, and that the separation distance between the two mesopause altitudes could vary from a maximum of about 30 km over the equator to zero over the poles. It is finally shown that these conclusions are not necessarily inconsistent with the sparse experimental data presently available. Author

N65-10919# AVCO Corp., Wilmington, Mass. Research and Advanced Development Div.
RESEARCH ON SPREAD-F STUDIES Final Report
John R. Herman 31 Jan. 1964 73 p refs
(Contract AF 19(628)-2788)
(RAD-TR-64-9; AFCRL-64-65; AD-602546)

The results of ionospheric observations using a variety of techniques are summarized to show that magnetic-field-alined irregularities exist in the ionosphere. The irregularities appear in patches having horizontal dimensions up to 1000 km in the east–west direction and several hundred kilometers in the north–south direction. Size of the irregularities is typically about 1 km transverse to the magnetic field and elongated along the field line. Irregularities associated with spread F occur in the altitude range from 250 km up to the height of F_{max}. Correlations between ionogram spread F and other ionospheric observations indicate that spread echoes are closely related to the field-alined irregularities. A critique of theories explaining why the irregularities cause spread echoes is given. Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N65-10013# France Office National d'Etudes et de Recherches Aeronautiques, Chatillon-sous-Bagneux

ORGANIZATION AND AUTOMATIC ANALYSIS OF MEASUREMENTS IN THE ARC TUNNELS OF O.N.E.R.A. [ORGANISATION ET DEPOUILLEMENT AUTOMATIQUE DES MESURES DANS LES SOUFFLERIES A ARC DE L'O.N.E.R.A.]

Michel Delattre 1964 6 p In FRENCH Presented at the 1st Intern. Congr. on the Instrumentation of Aerospace Simulator Installations; organized by IEEE, Paris, 28–29 Sep. 1964 (ONERA-TP-158(1964))

Since the power installation to produce the electric arc at the O.N.E.R.A. facility provides 4800 megavolts-amperes, whereas the probes that make measurements inside the tunnel have sensitivities corresponding to 10^{-12} watts, a magnetic cage has been devised as a shield against parasitic currents. This installation is described, as well as the organization adopted for the entire system of measuring devices, that include pressure, force, and thermal-flux probes. Analyses of the errors inherent in each of these probes and in the entire system are included. M.P.G.

N65-10038# Phillips Petroleum Co., Idaho Falls, Idaho Atomic Energy Div.

SOME USES OF TIME OF FLIGHT TECHNIQUES IN CONJUNCTION WITH A NEUTRON CRYSTAL SPECTROMETER

R. R. Spencer Sep. 1964 20 p refs

(Contract AT(10-1)-205)

(IDO-17029) OTS: $0.50

A fermi-type rotor has been used in conjunction with the MTR neutron crystal spectrometer as a means of separating the various orders of Bragg reflection. By chopping the spectrometer Bragg neutron beam and by time-of-flight analyzing the resulting neutron bursts, it has been possible to eliminate order effects in neutron transmission measurements, to observe the many high-order reflections in a mica crystal, and to observe the "forbidden" Be(001) reflection that is simulated by multiple scattering. Author

N65-10044*# New Hampshire U., Durham

DESIGN OF A NEUTRON MONITOR FOR MEASUREMENTS IN SPACE Scientific Report No. 1

J. A. Lockwood and L. A. Friling [1964] 73 p refs

(Contract NASr-164)

(NASA-CR-59403) OTS Prices: HC $3.00/MF $0.75

A neutron monitor, consisting of an He^3 proportional counter encased in a polyethylene moderator that, in turn, is surrounded by charged particle counters, has been constructed and tested. The efficiency of this neutron detector system is 2.0 counts/neutron/cm^2 for 14 MeV neutrons and 20 cts/n/cm^2 at thermal energies. The electronics system is designed to reject neutron events occurring within 200 μsec after a charged particle counter is triggered, thereby providing discrimination against neutron production in the detector. A Li^6I scintillator encased in a plastic scintillator, which acts as both a moderator for the neutrons and a charged particle detector, has also been built and tested. Author

N65-10062# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

EFFECT OF HIGH-ENERGY PROTONS ON SEMICONDUCTOR NUCLEAR-RADIATION DETECTORS

L. S. Brykina, B. M. Golovin, A. P. Landsman, B. P. Osipenko, and O. P. Fedoseyeva *In its* Cosmic Res., Vol. 2, No. 4, 1964 11 Sep. 1964 p 186–192 refs (See N65-10051 01-30)

The action of high-energy protons on surface-barrier silicon nuclear-radiation detectors is studied. Data are obtained on the dependence of pulse amplitude, the signal-to-noise ratio, and energy resolution as functions of the radiation dose that has been received by the detector. A working model developed earlier is used for estimation of the lifetimes of such detectors in the earth's radiation belts. Author

N65-10080# Joint Publications Research Service, Washington, D.C.

WIDE-BAND RADIOINTERFEROMETER WITH AN ELECTRICALLY CONTROLLED DIRECTIVITY PATTERN

L. L. Baselyan, Yu. M. Bruk, I. N. Zhuk, A. V. Men', L. G. Sodin' et al *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 30–44 refs (See N65-10076 01-23) OTS: $6.00

A wideband (20 to 40 Mc) radio interferometer with a 470-m base oriented in the east–west direction is described. The interferometer consists of two plane arrays, each having 128 dipoles, with stepped remote electrical control of the directivity pattern in a meridian plane (over a ±90° sector). The electrical circuit of the system and the measurement data are given. Author

N65-10126# Joint Publications Research Service, Washington, D.C.

IZVESTIYA VUZov: INSTRUMENT BUILDING, NO. 4, 1964

S. I. Zilitinkevich, ed. 27 Oct. 1964 234 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Priborostr. (Leningrad), v. 7, no. 4, 1964 p 1–172

(JPRS-27089; TT-64-51345) OTS: $6.00

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N65-10127# Joint Publications Research Service, Washington, D.C.

INSTRUMENT FOR MEASUREMENT OF ELECTRON CONCENTRATION IN PLASMA

Ye. A. Stakhov *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 1–8 refs (See N65-10126 01-14) OTS: $6.00

A description is presented of an instrument for the measurement of the electron concentration in plasma, consisting of a microwave interferometer using a modulator based on a gas-discharge device. The use of the gas-discharge modulator permits obtaining a significant frequency shift that considerably improves the resolving power of the interferometer in time. The gas-discharge modulator is insensitive to overload. It is long lived, reliable in operation, simple in design, and can be built in laboratory conditions. Author

N65-10143# Joint Publications Research Service, Washington, D.C.

ON THE THEORY OF THE GYROCOMPASS

N. V. Butenin and A. I. Lestev *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 127–135 refs (See N64-10128 01-14) OTS: $6.00

The effects of dry friction in the support bearings and of latitude on the motion of a gyrocompass and of an azimuthal gyro are investigated in detail. It is assumed that the gyrocompass is rigidly mounted to the earth so that the axis of rotation of the outer ring is vertical. The movement of the gyro spin axis relative to the system of coordinates $O\xi\eta\zeta$ fixed to the earth is determined. The origin of the coordinates is taken as the point of intersection of the gimbal axes. A second system of coordinates Oxyz is fixed to the rotor of the gyrocompass, so that the two systems of coordinates coincide when $\psi = 0$, $\theta = 0$, where ψ is the rotation of the outer gimbal ring relative to the axis $O\zeta$, and θ is the angle of rotation of the inner gimbal axis relative to the axis Oy. Precessional equations of motion are derived, and stagnation regions where there is no apparent motion of the gyro are determined. M.P.G.

N65-10144# Joint Publications Research Service, Washington, D.C.

ON THE SYSTEMATIC DRIFTS OF THE PLATFORM OF A THREE-AXIS GYROSTABILIZER WITH OSCILLATIONS OF THE BASE

Ya. L. Lunts *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 136–141 refs (See N65-10126 01-14) OTS: $6.00

The effect of oscillations of the platform on two-degree-of-freedom gyros mounted on it is considered. The deviations of the gyros are of a systematic nature, and lead to the operation of the stabilizing motors. Platform "tilts" appear. Equations are derived for the calculation of the angular velocities of these tilts. Author

N65-10145# Joint Publications Research Service, Washington, D.C.
DEVICE FOR THE STUDY OF THE ATTENUATION OF RADIATION BY PARTICLES SUSPENDED IN THE AIR
B.P. Kozyrev and A. V. Mezenov *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 150–156 refs (See N65-10126 01-14) OTS: $6.00

A description is given of equipment for the performance of the investigation of radiation attenuation in the frequency band from 0.5 to 1000 mc by water droplets suspended in the air. For the monochromatization of the radiation, use is made of the methods of residual rays, cutoff filters, and the diffraction grating. Author

N65-10163# Paris Observatory, Meudon (France)
SPECTROSCOPY BY FOURIER TRANSFORMS: INTRODUCTORY REPORT [SPECTROSCOPIE PAR TRANSFORMEE DE FOURIER: RAPPORT INTRODUCTIF]
J. Connes *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 81–93 refs In FRENCH (See N65-10155 01-29)

The application of the method proposed independently by Fellgett and Jacquinot to the study of weak sources in the infrared, such as those studied in astronomy, is described. The method, in brief, consists of multiplex spectrography, using an interferometer that has two waves in which the energy corresponding to each spectral element falls on the receptor during the entire time of measurement. An immediate conclusion is then possible; each time that a receptor is used in such a way that the noise of the receptor is not augmented by the simultaneous arrival of all the spectral elements, the signal-to-noise ratio, which varies as the square root of the time of measurement, is multiplied by the $\sqrt{M}$. Theoretical problems posed by this method in the absence of noise are considered, followed by a discussion of the various means of obtaining the best signal-to-noise ratio possible in the presence of noise for a given interferogram. M.P.G.

N65-10164# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
INFRARED INSTRUMENTATION IN SPACE EXPLORATION: INTRODUCTORY REPORT
Frank B. Gray *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 94–104 refs (See N65-10155 01-29)
(Contract NAS7-100)

The types of infrared system components that have proved reliable in space applications are reviewed. Components discussed include detectors, cooling systems, choppers, filters, gratings, and calibration sources. Successful systems built up from these components include radiometers, spectrometers, and vehicle control systems. Some new developments exhibiting definite promise for space-oriented IR measurements are also discussed. M.P.G.

N65-10165# Harvard Coll. Observatory, Cambridge, Mass.
NEW DEVELOPMENTS OF THE FERROELECTRIC BOLOMETER FOR ASTRONOMICAL APPLICATION
Hector C. Ingrao, Frederic J. Kahn, and Donald H. Menzel *In* Liege U. Infrared Spectra of Astron. Bodies 1964 p 105–119 refs (See N65-10155 01-29)
(Grant NsG 64-60)

Ceramic ferroelectric bolometers were manufactured that have curie points between $-10°$ and $+10°$C and dimensions down to 0.5 mm × 0.5 mm × 50μ. The performance of a radiation pyrometer was measured, that has a ferroelectric bolometer 1.0 × 1.0 × 0.2 mm, with an incident square-wave infrared signal of 5.8×10^{-9} W peak-to-peak, mechanically chopped at 2.5 cps and a band pass $\Delta f = 0.25$ cps. The noise level of the system is 4.2×10^{-10} W rms. Theoretical values of the responsivity and minimum detectable power of the detector are compared with experimental data. Author

N65-10166# Block Associates Inc., Cambridge, Mass.
INFRARED FOURIER TRANSFORM SPECTROMETRY FROM SPACE VEHICLES
L. Mertz *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 120–124 (See N65-10155 01-29)

The success of two satelliteborne Fourier-transform interferometer spectrometers in obtaining earth spectra (2μ to 16μ resolution $\sim 40\,cm^{-1}$) demonstrates their capabilities. The enormous "throughput" (luminosity) per unit volume of interferometers allowed compact durable instrumentation. The interferometers are further suited to the space environment in that a small reciprocating mirror is the only moving part. The principal topic of this communication, however, is an elucidation of the phase properties of interferograms. These properties may be modified to reduce the necessary dynamic range of Fourier transform spectrometry. Such reduction is necessary if telemetry is to be used efficiently. Author

N65-10168# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOME ASPECTS OF NOISE ANALYSIS OF INTERFEROMETER SPECTROMETERS
Dale R. Lumb and Gordon C. Augason *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 132–147 refs (See N65-10155 01-29)

This paper analyzes the appearance and distribution of noise on a spectrum obtained by a Fourier transformation of an interferogram that was the source of the spectrum and noise. This is accomplished through a discrete formulation by use of sampling theory and statistical methods. As a consequence of this formulation, a noise comparison of conventional spectrometers and interferometers is readily obtained, verifying that Fellgett's advantage does hold for interferometers with nonbackground limited detectors. Author

N65-10177# Oxford U. (Gt. Brit.) Clarendon Lab.
BALLOON MEASUREMENTS OF EMISSION FROM THE 6.3 MICRONS WATER-VAPOUR BAND
E. J. Williamson Liege U. Infrared Spectra of Astron. Bodies 1964 p 327–335 refs (See N65-10155 01-29)

A balloonborne infrared radiometer is described. The instrument is designed to measure night emission from the 6.3μ water-vapor band using a liquid-air-cooled gold-doped germanium detector. Measurements at heights up to 20 km have been obtained. Interpretation of the data is discussed, and the results are used to calculate the vertical distribution of water vapor. Author

N65-10195# Johns Hopkins U., Baltimore, Md.
A DAYTIME ACQUISITION SYSTEM FOR BALLOON ASTRONOMY
John Strong and Murk Bottema *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 528–532 refs (See N65-10155 01-29)
(Contract AF 19(628)-202)

A daytime tracking system for infrared planetary spectroscopy from balloonborne platforms is described. Offset suntracking is used for coarse tracking, and a star tracker for fine tracking. An ultimate precision of 5 to 10 sec during a 2-hour observation period is attained. Author

N65-10198# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering
A DOSIMETRY SYSTEM FOR THE FLASH X-RAY
Ward F. Petrie (M.S. Thesis) Aug. 1964 98 p refs
(GSP/Phys/64-12; AD-603608)

A dosimetry system for the Flash X-ray, which is a pulsed radiation source, was sought. A system must meet the criteria that are indicated by the Flash X-ray characteristics. These are energy independence in the range 40 keV to 600 keV, dose-rate independence in the range 10^7 to 10^9 R/sec, and sensitivity as low as 100 mR. All systems were eliminated except the LiF thermoluminescent dosimeter. It met adequately the needs of the Flash X-ray, but possessed some problem areas, including slight energy dependence, a thermal radiation problem on readout, and light sensitivity; however, these were either controllable or negligible. Author

N65-10224# Navy Electronics Lab., San Diego, Calif.
ACOUSTIC TRANSDUCER EVALUATION CENTER (TRANSDEC). NONREVERBERATING POOL DEVELOPED AT NEL FOR CALIBRATION AND EVALUATION Research and Development Report, May 1959–Dec. 1963
C. E. Green 24 Aug. 1964 30 p refs
(NEL-1232; AD-449746)

An anechoic sonar calibration pool was designed and built to behave as an infinite body of water; a computer and associated equipment were provided to permit complete analog evaluation of transducers of normal frequency range, size, and weight; and a bridge was constructed to house equipment and personnel, as well as to isolate them acoustically from the water. The performance of the pool proved the value of its design, and a patent was granted on the contour of the pool. D.E.W.

N65-10229 France. Office National d'Etudes et de Recherches Aeronautiques, Chatillon-sous-Bagneux
TRANSITORY RESPONSE OF THERMAL RECEPTORS UTILIZING THERMOCOUPLES [REPONSE TRANSITOIRE DE CAPTEURS THERMIQUES UTILISANT DES THERMOCOUPLES]
Jean-Pierre Chevallier 1964 5 p refs In FRENCH Presented at the 1st Intern. Congr. on the Instrumentation of Aerospace Simulator Installations; organized by IEEE, Paris, 28–29 Sep. 1964
(ONERA-TP-157(1964))

A numerical résumé of a thermal transitory one-dimensional problem for conditions limited particularly to the operation of sondes having thermoelectric couples is presented. The contact temperature is obtained as a function of time for a point of a wire when, on all sides, a limited length is subject to a convective flux corresponding to a range of temperature of the ambient medium. The results obtained are applicable to the determination of the time response of temperature-delay probes and flow probes. They permit evaluation of the inherent errors and, in certain cases, of the corrections, or else give the characteristics of the sensitive element, that permit them to be eliminated. Trans. by M.P.G.

N65-10242# Aerojet-General Corp., Downey, Calif.
SHAPED CHARGE HYPERVELOCITY PROJECTOR ADVANCEMENT AND DATA GATHERING Final Report, Sep. 1962–Mar. 1964
R. R. Randall Eglin AFB, Fla., Res. and Technol. Div., Sep. 1964 61 p refs *Its* Rept.-0708-01(02)FP
(Contract AF 08(635)-2809)
(ATL-TR-64-66; AD-607133)

The hypervelocity range was modified to incorporate vacuum-pumping equipment capable of simulating a pressure equivalent to an altitude of 200 000 ft within the test chamber. Tests were conducted to verify performance of these modifications and to train personnel in the techniques and intricacies of data accumulation using the explosive-shaped-charge projector. Approximately 200 explosive-shaped-charge projector experiments have been conducted, with particular emphasis given to increasing the mass, velocity, and dispersion of projectiles formed by these projectors. Author

N65-10271# DODCO Inc., Blawenburg, N.J.
SUMMARY OF REQUIREMENTS FOR AIR DATA SENSORS ON LIFTING RE-ENTRY AND GLIDE RETURN SYSTEMS Summary Report
Daniel O. Dommasch Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Aug. 1964 31 p refs
(Contract AF 33(615)-1410)
(FDL-TDR-64-73; AD-607210)

A study of the requirements for use of air data for reentry and glide return weapon systems is discussed. The systems functions of control, display, prediction, protection, guidance, and backup are dealt with, and the nature of several proposed reentry systems is examined. An analysis is made of obtainable accuracy in the prediction of aerodynamic and air data parameters pertinent to reentry systems. Results of numerical multidegree of freedom simulations of an arbitrary reentry vehicle and the now defunct X-20A weapons system are provided to establish the effects of parameter variations on reentry paths. Feasibility of a nongyro, nonstructural mode coupling, three-axis air-data-based reentry control system is established within the restriction that proper air-data sensors are available. Author

N65-10312# California U., Berkeley Lawrence Radiation Lab.
DEVELOPMENT, TESTING, AND CALIBRATION OF THE LRL THERMOLUMINESCENT DOSIMETRY SYSTEM
Francis M. Miller and Lowell M. Kleppe 24 Aug. 1964 18 p refs
(Contract W-7405-ENG-48)
(UCRL-11613) OTS: $1.00

The lithium fluoride thermoluminescent dosimetry system is capable of measuring doses of gamma radiation from 10 mR to more than 30 000 R. Calibration curves were obtained for gamma radiation from cobalt and radium, X-rays of 100 kVp and 250 kVp, high-energy protons and alpha particles, and for both 5-MeV and thermal neutrons. The problems of reducing variations in the photomultiplier dark-current magnitude and in increasing the overall stability of the system were solved by use of an infrared filter, the standardization of the operating procedure, and the cooling of the face of the PM tube with room-temperature dry-nitrogen gas. Author

N65-10378# Hawaii Inst. of Geophysics, Honolulu
AN ANALYSIS OF THE RELIABILITY OF GRAVIMETER MEASUREMENTS Scientific Report No. 3
G. P. Woollard Jun. 1964 31 p refs
(Contract AF 19(628)-2849)
(HIG-64-9; AFCRL-64-771; AD-607479)

The reliability of high-range gravimeters used for intercontinental connections depends primarily on the linearity in response of the overall system and its adequate calibration. Tests conducted indicate the most serious problems associated with the instruments were the establishment of a reliable laboratory calibration, maintainance of calibration with time, changes in magnetic field response with time, and reliability of small-increment (10 to 40 mgal) changes. Although both

instruments tested were manufactured to the same specifications and weight calibrated in the laboratory at approximately 200-mgal increments over their range of 6000 mgal, the adjustment required for a best fit to adopted values on the North American standardization range differed by approximately 12.2 mgal/1000 mgal. Author

N65-10395# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CONTACTLESS PHOTOPOTENTIOMETER
S. V. Svechnikov 14 May 1964 7 p Transl. into ENGLISH from Avtomat. i Telemekh. (Moscow), v. 24, no. 9, 1963 p 1292–1294
(FTD-TT-64-321/1+2; AD-607562)

The possibility of using photoresistors as elements of contactless potentiometers controllable in the function of voltage is discussed. The results of elementary investigation of photopotentiometers on the basis of photoresistors of the types FSK-M, and SKF-M are presented. Author

N65-10396# Aeronutronic, Newport Beach, Calif.
EXPERIMENTS FOR DETERMINING THE EFFECTS OF THE ATMOSPHERE ON LONG RANGE OBLIQUE PHOTOGRAPHY Technical Documentary Report, Jul. 1963–Jul. 1964
J. H. Atkinson, P. G. Mc Manigal, and B. G. Foster Wright-Patterson AFB, Ohio, Res. and Technol. Div., Jul. 1964 154 p refs
(Contract AF 33(657)-11670)
(AL-TDR-64-153; AD-607271)

The object of this project was to design experiments and appropriate instrumentation for investigating the effects of the atmosphere on reconnaissance photography. These experiments are described in detail, along with their basic underlying theory. The instrumentation is also fully described with drawings and schematic diagrams where available. Experimental sites have been investigated, and information concerning them is presented. The complete program for the performance of the experiments, and the manner in which the experimental results will be used to formulate a workable theory of long-range oblique photography are outlined. Author

N65-10403# Army Missile Command, Huntsville, Ala. Army Inertial Guidance and Control Lab.
NORTH-SEEKING PLATFORM DEVELOPMENT UNDER SUPPORTING RESEARCH TASK "IMPROVED LAYING AND AIMING TECHNIQUES"
J. V. Johnston 24 Jul. 1964 37 p refs
(RG-TR-64-5; AD-450200)

This report includes a quantitative study and the progress made on a north-seeking platform. The north alinement scheme and mechanization presented is a radically new concept in gyrocompassing techniques. The primary motivation for investigating this approach stems from the successful development of a high precision north-seeking gyro. This north-seeking gryo, of the pendulous configuration, was developed in-house as a surveying instrument. By continuous attempts to apply the dynamic pendulous techniques to a stabilized platform, a mechanization was finally conceived that proved to be feasible. The feasibility was demonstrated with a surplus ST-90 (Jupiter) platform and a modified AB-7 gyro. Even though the components had over 800 hours of operation prior to the modifications, the test results indicated the following: The system will gyrocompass to better than one minute of arc while subjected to large random input vibrations and shocks. The servoamplifier gain associated with the gyrocompassing loops can vary ±30% without causing more than ±2 seconds of arc error. The repeatability of the system was ±10 seconds of arc under conditions of seismic vibration, temperature variation, and day-to-day stability. Author

N65-10420# Canadian Armament Research and Development Establishment, Valcartier
AN AFC SYSTEM FOR A MICROWAVE CAVITY SPECTROMETER
J. Gilbert and R. Vaillancourt Sep. 1964 15 p
(CARDE-TN-508/64)

A usual requirement with cavity spectrometers is to hold the microwave source at the resonant frequency of the test cavity. An automatic bridge system using coherent superheterodyne detection whereby the local oscillator is phase-locked to the signal oscillator is described. The principles of operation are discussed along with some of the basic design requirements. It is shown that the discrimination sensitivity of the system is the same as the Pound stabilization technique. The method is particularly advantageous in bridge spectrometers, since it enables the maximum efficiency of the superheterodyne detection to be achieved over a large operational bandwidth. Author

N65-10440# Naval Ordnance Lab., Corona, Calif. Research Dept.
MILLIMETER INTERFEROMETER
J. W. Battles and D. E. Crane 1 Aug. 1964 17 p refs
(NAVWEPS-8201; AD-603544)

A millimeter interferometer, based on the Froome interferometer, has been designed and built in such a way that no calibration is necessary to measure the complex dielectric constant of a given material. The interferometer (which has been operated at 35 Gc) is mathematically described, and its operation is explained. Ultimately, the unit is expected to be operable at frequencies greater than 70 Gc. Author

N65-10444# Army Missile Command, Huntsville, Ala. Electromagnetics Lab.
A DIGITAL ERROR DEVELOPER AND POSITION PROCESSOR FOR THE OPTICAL DISCRIMINATION SYSTEM, TWO-AXIS GIMBAL SYSTEM
Michael John Sakellarides 22 Sep. 1964 19 p refs
(RE-TR-64-18; AD-450026)

A discussion of the logic design and fabrication of the digital error developer, which is associated with an Optical Discrimination System is presented in detail. The function of the digital error developer is to receive inputs from 13-bit digital optical shaft encoders and to provide positional analog error signals for a servo driven 2-axis sensor mount. Design objectives, specifications, and operational environment are described. The report is an analysis of the design, beginning with an introduction to the problem, followed by a discussion of the completed computer with associated illustrations. This computer has been integrated in an operational system for use in field tests. Author

N65-10566# Naval Ordnance Lab., White Oak, Md.
A STUDY OF SLIT DETECTION BY RADIOGRAPHY
E. L. Criscuolo and D. P. Case Aug. 1964 30 p refs
(NOLTR-64-55; AD-604351)

Slit detection by radiography is dependent upon image contrast, dimensions of the slit, and unsharpness. Experiments show that the contrast reduction factor for narrow slits is not a linear relation with unsharpness. Thus the equations based upon theory are valid for slit widths either several times

smaller or larger than the unsharpness. For conditions where the unsharpness and slit width are of the same order of magnitude, an empirical formula must be used. Author

N65-10570# France. Office National d'Etudes et de Recherches Aeronautiques, Chatillon-sous-Bagneux
MEASUREMENT OF FORCE IN AN ARC TUNNEL BY A PIEZOELECTRIC BALANCE OF THREE COMPONENTS COUNTERBALANCED IN INERTIA [MESURE DES EFFORTS DANS UNE SOUFFLERIE A ARC UNE BALANCE PIEZOELECTRIQUE A TROIS COMPOSANTES COMPENSEE EN INERTIE]
Jean Berry and Roland Hoarau 1964 9 p refs In FRENCH Presented at the 1st Intern. Cong. on Aerospace Simulator Installations; organized by IEEE, Paris, 28–29 Sep. 1964 (ONERA-TP-159(1964))

A piezoelectric balance designed to measure aerodynamic forces on models in an arc tunnel is described. This balance directly overcomes the errors in the results of scale-model testing due to the effects of the model supports, by electrically filtering the inertia signals so that their average value is zero. The scheme of inertia compensation used and the procedure for determining the compensation coefficients are given. A block diagram of the analog calculator system and results of test runs are also included. M.P.G.

N65-10585# Itek Corp., Lexington, Mass.
STUDY OF IMAGE-EVALUATION TECHNIQUES Interim Engineering Report No. 4, 15 May–15 Aug. 1963
G. C. Brock, E. Inglestam, E. P. Myskowski, W. L. Attaya, and R. L. Dussault [1963] 54 p
(Contract AF 33(657)-9158)
(Itek-9048-4; AD-422487)

Theoretical and experimental investigations of the response of lens and lens–film systems to bar targets were continued. Optical-scanning experiments were performed that verified theoretical response data for three-, two-, and one-bar targets. The results were compared to sine-wave and square-wave response. Work has continued in determining the system transfer function by means of calculations, using experimentally determined system edge response data. Limited subjective and objective analyses of simulated aerial photography were completed for conditions of constant scale and haze, and of varying transfer functions and emulsion granularities. A 1:2000-scale positive transparency of a town was photographed to a final scale of 1:40 000 with a 6-inch-focal-length lens whose response characteristics were carefully determined. P.V.E.

N65-10603# Royal Inst. of Tech., Stockholm (Sweden)
TOLERANCES OF PHOTOGRAMMETRIC INSTRUMENTS AND METHODS
B. Hallert Göteborg, Elanders Boktryckeri Aktiebolag, 1964 25 p refs *Its* Trans. No. 230 Available from Elanders Boktryckeri Aktiebolag: Kr. 3:50

The paper presents principles for the establishment of tolerances for photogrammetric instruments and methods and practical applications. The tolerances are founded upon calibration measurements, adjustments according to the method of least squares, the laws of error propagation, and the confidence-limit theory from statistics. Author

N65-10605# International Society for Photogrammetry, London (Gt. Brit.)
FUNDAMENTAL PROBLEMS IN PHOTOGRAMMETRY, 1960–1964 Commission II
B. Hallert, L. Ottoson, and K. A. Ohlin 1964 111 p Partially sponsored by Swedish Tech. Res. Council and U.S. Army

Methods for the testing of fundamental operations of photogrammetry and their application to actual problems have been studied. Photographs from aerial cameras have been calibrated and tested by the use of the method of least squares. The main source of errors in the photogrammetric procedure was found in the image coordinates of the basic photographs. The shrinkage of the emulsion and emulsion base was recognized to be the most important source of this error. It is urged that tolerance values be established and applied to materials, instruments, operators, and methods. G.G.

N65-10675# Naval Ordnance Lab., Corona, Calif. Research Department
SUBMILLIMETER RADIOMETRY
J. W. Battles and D. E. Crane 1 Nov. 1963 34 p refs
(NAVWEPS-8169; AD-424017)

This report discusses some of the problems involved in defining the parameters of a submillimeter radiometer. Areas in which there is a need for experimental measurements are outlined; a short survey is given of millimeter- and submillimeter-wave components, and future plans of the submillimeter research program are discussed. Author

N65-10723# National Bureau of Standards, Boulder, Colo.
EXPERIMENTAL EVALUATION OF A THALLIUM BEAM FREQUENCY STANDARD
R. E. Beehler and D. J. Glaze *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 392–407 refs (See N65-10701 01-07)

A preliminary evaluation of a short thallium-atomic-beam frequency standard is discussed. The evaluation was conducted in an effort to determine if the use of thallium would result in a substantially improved atomic frequency standard. The evaluation indicated that such a machine may offer improved accuracy and comparable precision to a similar cesium standard. It is concluded that although cesium standards still have advantages in terms of convenience and consistency of operation, further work on thallium at an accelerated pace would seem to be warranted. P.V.E.

N65-10801*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISON OF MEASUREMENTS OF INTERNAL TEMPERATURES IN ABLATION MATERIAL BY VARIOUS THERMOCOUPLE CONFIGURATIONS
Marvin B. Dow Washington, NASA, Nov. 1964 21 p refs
(NASA-TN-D-2165) OTS Prices: HC $0.50/MF $0.50

The internal temperatures measured by various thermocouple configurations in a charring ablator and in a porous ceramic subjected to severe heating in an electric-powered arc jet are discussed. The results show that measurement errors of several hundred degrees can result from the conduction of heat from the hot junction of the thermocouple by the thermocouple lead wires. The measurement of internal temperatures in materials with low values of thermal conductivity subjected to severe heating by thermocouples requires that the thermocouple produce a minimum temperature disturbance within the material. A comparison was made of several thermocouple sensors designed to minimize internal temperature disturbances caused by heat conduction from the hot junction by the sensor material. These thermocouple sensors had short lengths of the sensor lead wire in the isothermal plane of the hot junction. This comparison showed that the temperatures indicated by these thermocouple sensors agreed reasonably well. Author

N65-10819*# Geophysics Corp. of America, Bedford, Mass.
SOLIDS MASS SPECTROMETER Fourth Quarterly Technical Progress Report, 4 Aug.–3 Nov. 1964
[1964] 13 p
(Contract NASw-839)
(NASA-CR-59492) OTS Prices: HC $1.00/MF $0.50

A further significant reduction of the instrumental background was achieved by improved oil-free pumping of the duoplasmatron arc chamber and of the target chamber. Impurities produced by the existing target holder were eliminated by replacing it with an adapter of spectroscopically pure tantalum. The sensitivity of the instrument has been extended by improving the background and by installing a digital memory oscilloscope. In the case of boron-doped silicon, boron levels down to 47 parts per billion have been detected in this manner. Other tests on spectroscopically pure samples of graphite and platinum have also demonstrated the sensitivity and versatility of the instrument. Author

N65-10827# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio
AN INVESTIGATION OF CYLINDRICAL STATIC PRESSURE PROBES
Paul David Smith (M.S. Thesis) Jun. 1964 86 p refs
(GAM/ME/64-19; AD-604829)

When the cylindrical pressure probe is used for measurement of the static pressure of a fluid stream, it is necessary to know the probe angular position, α_{crit}, at which the true static pressure is indicated. Values for α_{crit} are determined for 10 probe geometries in a Reynold's-number range from 2500 to 15 000. Significant results of the study are these: (1) Probes manufactured to the same specifications and with no visible differences give different values of α_{crit}. (2) Calibration of a probe at one Reynold's number for use at another can result in errors on the order of 10%. (3) The size of the nozzle used in the test had a significant effect on α_{crit}, and therefore any calibration test must accurately duplicate the conditions under which the probe is to be used. A theoretical prediction of α_{crit}, based on two-dimensional flow of a perfect fluid around a circular cylinder, indicated that the assumption of two-dimensional flow is invalid, and that the orifice forms a surface discontinuity of such magnitude that the actual probe geometry would have to be used as boundary conditions for any analysis. D.S.G.

N65-10845# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering
HYPERSONIC FLOW VISUALIZATION USING THE GLOW DISCHARGE TECHNIQUE
John M. Fabian (M.S. Thesis) Jun. 1964 90 p refs
(GAM/ME/64-6; AD-604825)

The electrical discharge is identified as a classical glow discharge, and its characteristics are discussed. The quality of visualization is found to depend upon electrode position relative to the stream, and model position relative to the transverse plane containing the electrodes. The effect of electrode polarity is investigated and found to be critical. The validity of the results is determined by using schlieren results and Van Dyke's numerical solution for axially symmetric shock-wave shapes. The effectiveness of the technique is determined by comparison of the results with those obtained using schlieren. Tests were conducted to determine the effect of the discharge on model temperature and pressure, as well as on the flow pattern as portrayed by schlieren photography. Author

N65-10848# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering
CONSTRUCTION, TEST, AND CALIBRATION OF A HIGH-TEMPERATURE DIPHENYL ETHER DROP-TYPE CALORIMETER
Thomas Marion Mc Millin (M.S. Thesis) Jun. 1964 38 p refs
(GAW/ME/64-1; AD-604831)

This type of calorimeter measures the expansion of the melting substance after a heated sample is dropped into the area of the frozen substance. A furnace designed for operation up to 1500° C heats the sample, and diphenyl ether provides the working substance that forces mercury along a calibrated capillary tube. Testing has permitted calibration of the capillary and calculation of the amount of heat lost from a sample during its drop from the furnace to the calorimeter. The calculated calorimeter constant of 19.1 cal/g Hg displaced agrees reasonably with constants determined by other researchers. The results of initial testing of platinum and nickel show correlation with published data. Discussions of problems, and recommendations for further work give guidance for refinement of the equipment. Author

N65-10851# Naval Research Lab., Washington, D.C. Transducer Branch
THE ANALYSIS OF VARIABLE RELUCTANCE TRANSDUCERS: THE ENERGY METHOD
R. M. Moore 20 Jun. 1964 23 p refs
(NRL-6089; AD-604336) OTS: $0.75

The operating equations of a variable reluctance transducer are derived through the application of the conservation of energy principle. These equations are formulated in terms of the energy stored in the magnetic field. The basic equations are shown to be nonlinear, and a set of approximate linear equations is derived for a special class of inputs. The method is applied to a double field, double mass transducer as an illustrative example. Author

N65-10862# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
A FULL-RANGE IN-REACTOR-CORE NEUTRON MONITORING SYSTEM EMPLOYING ION CHAMBERS. IN-CORE INSTRUMENTATION DEVELOPMENT PROGRAM Topical Report, Fiscal 1964
R. A. Du Bridge and W. K. Green Washington, AEC, Jun. 1964 19 p
(Contract AT(04-3)-189)
(GEAP-4643) OTS: $1.00

A system is described that is capable of measuring the complete range of neutron flux inside a reactor core from startup to full power (10^4 to 5×10^{13} nv). This is accomplished with two channels—a counting channel and a Campbell or variance signal channel. The counting channel consists of a high-pressure in-core ion chamber, isolated from the ground and completely shielded. To this is welded triax cable, which has good transmission qualities. The Campbell channel consists of a low-pressure in-core ion chamber, isolated from the ground and completely shielded. To this, low-capacity cable is integrally welded. The cable then is capacitively coupled to an ac amplifier, and finally the signal is fed into a true rms voltmeter. D.S.G.

N65-10927# Northrop Corp., Hawthorne, Calif. Support Equipment Branch
AGE ASTROINERTIAL INSTRUMENT TEST SET Final Report
R. A. Lindsey 7 Mar. 1963 39 p

The Astroinertial Test Set was employed to perform tape-programed functional tests on the Astroinertial Instrument to verify that the unit-under-test performed within specified design tolerances. Fully automatic testing of the AI was not possible due to the requirements for operator settings of the accelerometer null bias and the vertical reference orbit of the telescope platform axes. Manual controls were used for the platform gimbals and the telescope gimbals in the use of a Star Signal Simulator. The operation of the ATS accepted test stimulus initiation signals, generated test stimulus input signals to the AI, and transferred tape-programed table, trunnion, and yoke axis positions to the Calibrator Astro-Telescope (CAT), as well as received output signals from the AI and processed them for printout on paper tape, and finally processed CAT paper-tape punch data. G.G.

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N65-10020# Joint Publications Research Service, Washington, D.C.
FURNACE BRAZING OF METALS WITH CONTROLLED ATMOSPHERES
R. Ye. Esenberlin 6 Nov. 1964 107 p refs Transl. into ENGLISH of the book "Payka Metallov v Pechakh s Gazovoy Sredoy" Leningrad, 1958
(JPRS-27273; TT-64-51528) OTS: $4.00

This book presents the physicochemical bases and technological characteristics of the brazing of metals and alloys in controlled atmospheres, and describes the equipment needed for this purpose. The most widespread solders and gases used for nonoxidative brazing processes are cited. Author

N65-10021 Georgia Inst. of Tech., Atlanta Engineering Experiment Station
A FREQUENCY SELECTIVE POWER METER FOR MILLIMETER WAVES Final Report
M. W. Long 29 Jul. 1964 59 p refs
(Contract Nonr-991(10))
(AD-604021)

An interference modulation technique for microwave radiometry is described. The technique is considered for use in the development of a frequency selective power meter for operation over a wide range of frequencies. A device using this technique does not require the use of a coherent source, and the technique is applicable to wavelengths well into the low millimeter region. A tunable radiometer using interference modulation has been operated as a frequency selective power meter in the 4-mm region. As a source of microwaves for system calibration, a gaseous noise source having a known temperature was used. Measurements were made to determine the power output level from a crystal harmonic generator, and the 4-mm harmonic was also used with the system when operated with a frequency resolution between between half power points of 8% to investigate system selectivity and spurious responses. Author

N65-10153# Joint Publications Research Service, Washington, D.C.
CONDITIONS OF ENGAGEMENT AND CORRECTION IN AN ORTHOGONAL CYLINDRICAL-CONICAL TRANSMISSION
L. Ya. Liburkin *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 209-216 refs (See N65-10126 01-14) OTS: $6.00

This is the study of the geometry of the meshing of a plane wheel that has been cut using an involute gear cutter with a cylindrical involute gear, which differs from a gear cutter. It is shown that such a meshing is regular, i.e., that it provides a constant transmission ratio. Equations are obtained for the line of action, and for the working lines on the surfaces of the teeth of the gear and wheel. A study is made of the effect of correction of the gear on the nature of the contact of the teeth in the engagement. The procedure presented permits the the design of a cylindrical–conical transmission with localized contact having a specified location of the working line. Author

N65-10154# Joint Publications Research Service, Washington, D.C.
AN INVESTIGATION OF TENSIONING DEVICES WITH FIXED SPOOL
M. G. Parnes *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 217-228 (See N65-10126 01-14) OTS: $6.00

The limits of the application of inertialess tensioning devices are considered as a function of the minimum spool diameter, the diameter, and the mechanical properties of the wire being wound. Questions of the tensioning of wire in inertialess winding are also considered. Author

N65-10273# Bendix Corp., Southfield, Mich. Research Labs.
RESEARCH AND EXPERIMENTAL VERIFICATION OF SUPER COMPONENT DESIGN TECHNIQUES APPLIED TO A COLD GAS REACTION CONTROLLER
B. R. Teitelbaum Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Jul. 1964 49 p refs *Its* Rept.-2620-A
(Contract AF 33(657)-10155)
(FDL-TDR-64-100; AD-607662)

This study is concerned with the application of super component design techniques to a representative nonelectronic flight control component, and evaluation of the reliability improvement attained by means of tests performed on groups of standard and super units. The representative component used was a cold gas, proportional-mode reaction controller for space vehicle attitude control applications. Three super controllers and four standard controllers were fabricated and tested according to a plan that simulated, as far as was practical, a mission profile. The test results tended to show the super units had advantages over the standard units in regard to specific failure modes. However, no statistically significant difference in life characteristics between the two groups was demonstrated. Author

N65-10276# General American Transportation Corp., Niles, Ill. MRD Div.
DEVELOPMENT OF NONDESTRUCTIVE TESTING METHODS FOR THE EVALUATION OF THIN AND ULTRATHIN SHEET MATERIALS Technical Documentary Report, 30 May 1963-1 Jun. 1964
G. Schmitz, A. Wieczorek, and M. Levine Wright-Patterson AFB, Ohio, AF Mater. Lab., Sep. 1964 46 p refs
(Contract AF 33(657)-11228)
(ML-TDR-64-278; AD-608072)

This report describes activity on the subject program for the first year including a survey of literature, equipment, research efforts, and nondestructive testing needs. As a result of this survey, the second portion of the first year's activity was directed toward the development of thin-sheet nondestructive test instrumentation in the field of high-frequency eddy-current equipment, Lamb-wave ultrasonic techniques, and electrostatic testing techniques. The eddy-current instrument operates at 5 Mc. The Lamb-wave techniques are directed toward finding material parameter variations and laminations in thin sheet. The electrostatic tests utilized thin nonconductive samples, with application to ceramic-coated refractories considered. Author

N65-10309# Atomic Energy Commission, Washington, D.C. Div. of Technical Information
THE EFFECTIVENESS OF THE USE OF RADIOACTIVE ISOTOPES IN THE NATIONAL ECONOMY
Grigorii Fedorovich Mikheev and Vladimir Ivanovich Postnikov Nov. 1964 117 p refs Transl. into ENGLISH of the book "Effektivnost' Primeneniya Radioaktivnykh Izotopov v Narodnom Khozyaistve" Moscow, Gosatomizdat, 1962 103 p
(AEC-TR-5898) OTS: $4.00

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7. LIGHT INDUSTRY p 95–102 refs

N65-10311# Northrop Corp., Hawthorne, Calif. Norair Div.
DEVELOPMENT OF MANUFACTURING CAPABILITY FOR PRODUCING HIGH PERFORMANCE ALUMINUM AND MAGNESIUM ALLOY CASTINGS Quarterly Progress Report No. 1, 1 May–31 Jul. 1964
A. J. Iler Aug. 1964 49 p refs
(Contract AF 33(615)-1341)
(NOR-64-204; AD-603760)

Foundry processing methods were evaluated in the areas of gating and risering, metal fluidity, solidification, fluxing, sand, dendrite measurements, grain refinement, and heat treatment. Alloys were evaluated for use in the program. The magnesium alloys selected were those of the Mg-Zn-Ag-Zr series. Alcoa M710 with M.I.T. ST60 was the aluminum-alloy system chosen. R.L.K.

N65-10326# Sprague Electric Co., North Adams, Mass.
PRODUCTION ENGINEERING MEASURE FOR MECHANIZATION OF HIGH-RELIABILITY CAPACITORS Quarterly Report, 31 Mar.–30 Jun. 1963
E. Burke and W. F. Bell [1963] 18 p
(Contract DA-36-039-AMC-01460(E))
(QR-2; AD-423244)

The methods of performing the kraft tube crimp, the metal tube pre-crimp, and the metal tube final crimp have been determined for the component assembly machine. Details of an experimental conveyor and spinning mechanism for the cover soldering machine have been adopted. For the hot tubulation soldering machine the shape and location of the hot chamber have been decided, and a tubulation cleaning operation will be performed after crimping. Author

N65-10349# Miami U., Coral Gables, Fla. Inst. of Marine Science
OPTICAL RECTIFICATION AND GRIDDING OF SATELLITE PHOTOGRAPHS Semiannual Technical Report
H. V. Senn, P. J. Davies, and H. W. Hiser Jul. 1964 40 p refs
(Contract Cwb-10622)

An operational procedure has been developed for the optical rectification and gridding of satellite photographs. The procedure is described, and examples are shown to illustrate both the advantages and disadvantages of the optical rectification system over earlier methods that rectified the geographical grid rather than the TIROS photograph. The problems involved in this rectification system are largely those of achieving dynamic similarity between the film projection system with its spherical section, and the TIROS system that was actually used in obtaining the film (the vidicon camera photographed the true earth and its cloud cover at an angle). Finally, a relatively simple computer program is devised for the determination of the satellite tilt angle and the latitude and longitude of the TPP, when only the TSP coordinates and the satellite altitude are known. Author

N65-10352# Union Carbide Corp., Lawrenceburg, Tenn. Advanced Materials Lab.
PYROLYTIC COATING OF CARBON FILAMENTS Quarterly Progress Report, 15 Nov. 1963–15 Feb. 1964
K. J. Zeitsch and P. H. Higgs 29 Feb. 1964 26 p
(Contract AF 33(657)-11297)
(AD-447951)

Typical pyrolytic graphite coatings on individual carbon yarn filaments were found to increase the filament tensile strength from 92 000 to 130 000 lb/in.^{2}, which corresponds to an improvement of approximately 40%. The same type of coatings increased the thermal conductivity of carbon yarn filaments from 0.064 to 0.145 cal/sec-cm-°C at room temperature, and from 0.016 to 0.019 cal/sec-cm-°C at temperatures slightly above 2000° C. Variations in the integral pull strength of uncoated and pyrolytically coated carbon yarn are shown to be random and to follow an essentially normal gaussian pattern. Superposition of pertinent distribution curves is used to separate scatter from genuine effects of processing. In this fashion, the superiority of coated over uncoated carbon yarn is characterized in statistical terms. Author

N65-10357# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
BLADELESS GUIDE VANE FOR CENTRIPETAL TURBINES
A. V. Gubarev, G. A. Fillippov et al 13 May 1964 9 p ref Transl. into ENGLISH from Energomashinostr. (Moscow), v. 9, no. 2, 1963 p 38–39
(FTD-TT-64-141/1+2+4; AD-600608) OTS: $0.50

This is a study of a bladeless, vortex guide vane operating in one tangential supply of gas. An approximate method of calculating the guide vane is developed by the disregard of the viscosity of the working body, and by the assumption that the flow is one-dimensional. The experimentally proven, sufficiently high effectiveness of the bladeless guide vanes recommends their application in centripetal turbines, in order to reduce the turbine assembly weight and size without decreasing the efficiency. G.G.

N65-10361# Texas Instruments, Inc., Dallas
MATERIAL PROCESSING AND PHENOMENA INVESTIGATION OF FUNCTIONAL ELECTRONIC BLOCKS Fourth Quarterly Progress Report, 1 Jun.–31 Aug. 1963
Rowland E. Johnson and R. C. Sangster [1963] 94 p refs
(Contract AF 33(657)-9196)
(TI-08-63-124; AD-420097)

The epitaxial deposition of gallium–arsenic on a gallium–arsenic substrate was studied. The doping and the deposition rate of GaAs was found to be very flexible, and the evaluation of the deposition runs was problematic. Very good insulation qualities were observed in one successful high-resistivity deposition on GaAs, and it was judged suitable for further electronic block work. The diffusion from doped SiO_2 films was extended to n-type dopes, and a series of silicon depositions on GaAs were made. G.G.

N65-10365# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PLANETARY GEARS (SELECTED PARTS)
Wiktor Surowiak 2 Oct. 1964 27 p ref Transl. into ENGLISH from the book "Przekladnie Obiegowe (Planetarne)" Warsaw, Panstwowe Wydawnictwa Tech., 1959 p 6–7, 34–45, 456–466
(FTD-TT-64-654/1+2; AD-607306)

A detailed classification of planetary gears is presented, followed by a discussion of their applications in aircraft and helicopters where they are used primarily in the mechanical drive of the propeller as reductors and differential gears in the drive of two propellers by one engine. Planetary gears are also used in the construction of auxiliary aircraft equipment, such as pneumatic starters for driving compressors. Drawings of helicopter rotor-drive assemblies having vertical, tilted, and slant arrangements of driving engines and gears are presented. M.P.G.

N65-10373*# General Electric Co., Philadelphia, Pa. Re-entry Systems Dept.
FORMING ALUMINUM FOR SOLAR ENERGY CONCENTRATORS Quarterly Progress Report No. 2, 1 Jan.–31 Mar. 1964
F. J. Schmidt and I. J. Hess 10 Apr. 1964 39 p refs
(Contract NAS1-3309)
(NASA-CR-56022) OTS Prices: HC $2.00/MF $0.50

This paper pertains to the refinement of earlier parametric and design data, preparation of test specimens, and the checkout of the full process of aluminum forming for solar-energy mirrors. A 7-inch aluminum, parabolic mirror and two 2 1/2-inch hemispherical mirrors were electroformed. In each case, electroformed nickel masters were utilized. The physical property measurements of the electroformed aluminum specimens have been completed. G.G.

N65-10383# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE PROBLEM OF LUBRICATING JOURNAL BEARINGS WITH AN AXISYMMETRIC SUPPORTING SURFACE
I. Ya. Tokar' and P. S. Chernyakov 21 Sep. 1964 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan. i Mashinostr. (Moscow), no. 2, 1963 p 149–152
(FTD-TT-64-510/1+2+4; AD-607119)

This paper pertains to the development of formulas for the design calculations of end seals, and for axial bearings with a conic supporting surface. The steady flow of an incompressible viscous fluid between two axisymmetric surfaces, one of which is spinning and the other stationary, is examined by the application of the Navier–Stokes equations and the equation of discontinuity. Calculations for journal bearings with a conic supporting surface, and for journal bearings with a conic supporting surface and a band on the periphery, are presented. G.G.

N65-10384# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STARTING CONDITIONS ON PLAIN THRUST BEARINGS
M. Ye. Podol'skiy 30 Sep. 1964 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan. i Mashinostr. (Moscow), no. 1, 1963 p 197–200
(FTD-TT-64-509/1+2+4; AD-607113)

The hydrodynamics of an oil film has been considered, and the basic principles of operation of plain bearings at startup were established previously. The solution to the problem was carried out on the assumption that in the case of bearings with self-adjusting pads the ratio of the layer thickness at the gap inlet and outlet of oil is independent of time. This article deals with the problem more completely without introducing additional limitations imposed on the rotation of the pad. Author

N65-10388# Defense Documentation Center, Alexandria, Va.
O-RINGS A Report Bibliography
Thomas C. Goodwin, comp. Jan. 1964 28 p refs
(AD-422417)

Information on seals for propulsion, power transmission, spacecraft, fuel, and hydraulic systems is presented. Design specifications for extreme temperatures, pressures, and space environmental conditions are given. Subjects presented in this bibliography include references to design, configuration, and properties of O-ring seals as applied to guided missiles, submarines, guns, and electrical equipment. The 68 references cited cover a period from March 1953 to February 1963. Author

N65-10469# National Research Corp., Cambridge, Mass.
RESEARCH STUDIES RELATING TO THE DETECTION OF LEAKS IN A LARGE AEROSPACE SYSTEMS ENVIRONMENTAL CHAMBER
F. Feakes, J. Roehrig, F. Benner, N. Beecher, L. Werninck (Pittsburgh-Des Moines Steel Co.) et al Arnold AF Sta., Tenn., Arnold Eng. Develop. Center, Nov. 1964 105 p refs
(Contract AF 40(600)-1076)
(AEDC-TDR-64-237; AD-451008)

This final technical report presents design criteria for an overall leak-detection system. For each major component of the facility, design details are recommended that facilitate leak detection. Manufacturers' acceptance tests, checkout, construction, and operational test procedures are specified for each component. Instrumentation requirements, sensor locations, data readout equipment, methods of monitoring the total system, sensitivity of leak test procedures, and personnel and equipment requirements are described. The aim and form of the report are such as to make it useful to the experienced engineer faced with the vacuum problems of facility design, construction, and checkout, and ultimately, operation of the chamber. Author

N65-10470# Naval Ordnance Lab., White Oak, Md. Non-Metallic Materials Div.
NOL RING TEST METHODS
Marlin A. Kinna Nov. 1964 34 p refs
(NOLTR-64-156; AD-449719)

Methods have been developed for the evaluation of filament-wound composite structures making use of ring test

specimens. A method of ring fabrication and techniques for determination of ring tensile strength and ring interlaminar shear strength have been standardized and are presented. References are also cited for flexural and compression tests now in use. Author

N65-10562 Aeronautical Research Council (Gt. Brit.)
A THEORETICAL APPROACH TO AIR BAG SHOCK ABSORBER DESIGN
A. C. Browning London, HMSO, 1964 67 p refs
Supersedes RAE-TN-MECH-ENG-369, ARC-25134
(ARC-CP-751; RAE-TN-MECH-ENG-369; ARC-25134) HMSO: 12s 6d

A simple theory of the compression of a cylindrical air bag shock absorber has been studied in detail by means of over 1000 step-by-step integrations. Many features of practical air bag performance have been reproduced, and data charts are given that indicate the design parameters for useful bags. From these charts the effect of variation of bag loading, height, orifice area, and speed of descent can be appraised. The use of a strong patch covering the orifice, bursting at several pounds per square inch pressure, has been investigated, but, it gives little change in performance. If an extensible fabric is employed, an increase in both bag height and orifice area is necessary. Bags of very high or very low loading are found to be inefficient, and it is concluded that air bags are most suitable at a loading of 150 to 200 lb/ft^2. Author

N64-10586# Rensselaer Polytechnic Inst., Troy, N.Y.
FURTHER DATA ON THE JUNCTURE CONDITION OF TEMPERATURE AT THE INTERFACE OF TWO BODIES IN SLIDING CONTACT Technical Documentary Report, 1 Feb.–30 Apr. 1963
T. E. Simkins and S. L. Pu Wright-Patterson AFB, Ohio, AF Mater. Lab., Sep. 1963 90 p refs
(Contract AF 33(657)-10058)
(ASD-TDR-63-627; AD-422460)

The data include those with solid-film coated surfaces in sliding contact. The temperature jumps have been more thoroughly observed, and a more detailed explanation of the phenomena is given. From experimental data, average contact heat-transfer coefficients are calculated. These values are compared with experimental data of contact—thermal resistance for static contact—of smooth surfaces on rough surfaces. Author

N65-10599# Dow Chemical Co., Denver, Colo. Rocky Flats Div.
WHAT IS THE ACTUAL RESOLUTION OF SHADOWED REPLICAS?
C. W. Price 27 Oct. 1964 41 p refs
(Contract AT(29-1)-1106)
(RFP-389) OTS: $0.50

All shadowing materials produce either fine-grained films or dispersions of fine crystallites. The grain size or crystallite size is dependent upon the shadow material and the vacuum deposition conditions. This grain size or particle size restricts the resolution of shadowed replicas, but the extent of this restriction has not been clearly defined. A hypothetically ideal shadow material was improvised, and the effects of particle size and spacing on resolution were studied. Both lines and objects (regular polyhedra and circles) were used as specimens. Specimens were defined as being resolved when widths of lines or shapes of objects could be determined; specimens were defined as being detected when their general positions could be determined. Author

N65-10618# Air Force Systems Command, Wright-Patterson AFB, Ohio. AF Materials Lab.
AIR FORCE MATERIALS LABORATORY SOLID FILM LUBRICATION RESEARCH
B. D. Mc Connell Apr. 1964 17 p refs
(ML-TDR-64-46; AD-604654)

This report outlines the general range of bearing lubrication requirements of present aerospace vehicles, and briefly describes the range of requirements anticipated for future Air Force weapon systems. This report covers only those programs concerned with solid film lubrication, and contains discussion of both development-type programs and related basic or fundamental-type programs. Program objectives, approaches to the problems, data obtained to date, and future work are discussed for each program. Author

N65-10633*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
EVALUATION OF JOURNAL BEARINGS OF VARIOUS MATERIALS IN LOW-VISCOSITY FLUIDS, LIQUID NITROGEN, AND LIQUID OXYGEN
Robert E. Cunningham and William J. Anderson Washington, NASA, Nov. 1964 25 p refs
(NASA-TN-D-2223) OTS Prices: HC $0.75/MF $0.50

An experimental investigation was undertaken to determine the feasibility of operating journal bearings in cryogenic liquids at surface speeds comparable to those of current generation oxidant turbopumps. Tests were conducted with 1.0- and 1.5-inch-diameter bearings. Results from tests in liquid nitrogen and liquid oxygen were generally poor due to the difficulty of maintaining a hydrodynamic film. It is hypothesized that boiling of the cryogenic fluids may have occurred within the bearing clearance area, creating a two-phase-flow condition. A sharp decrease in the effective viscosity and in the bearing load-carrying capacity resulted. The best performance from tests with journal bearings fully immersed in liquid-oxygen was obtained with fused polytetrafluoroethylene (PTFE) coated wrought-nickel-copper alloy sleeves, a 15% glass-filled PTFE liner on steel, and PTFE plus lead in sintered bronze. These materials were capable of sustaining moderate loads at surface speeds to 76 fps for a short duration. Liquid-oxygen pressure fed to the bearings at approximately 5 psi gage above atmospheric pressure (boiling point, −302°F) did not improve performance over the tests fully immersed at atmospheric pressure. Results of screening tests conducted in a low-viscosity hydrocarbon with a number of materials showed good agreement with hydrodynamic theory. Hydrodynamic films were maintained over a range of surface speeds to 107 fps at unit loads to 200 psi. Author

N65-10656# Frankford Arsenal, Philadelphia, Pa.
EXPLOSIVE WELDING
H. J. Addison, Jr. May 1964 14 p refs Presented at the Design Eng. Conf. and Show, ASME, Chicago, 11–14 May 1964
(A64-13; AD-448884)

The explosive welding process through released energy from an explosive source was successfully applied in area, spot, and seam welds. The metal members were located between an explosive charge and an anvil with the lower member resting on the anvil. Satisfactorily welded edges, laps, and tee joints were obtained, and a number of metals and alloys in similar and dissimilar combinations were welded together. A tensile-shear strength approaching that of the base metal has been obtained in some metals in seam-welded lap joints. G.G.

N65-10660# Sprague Electric Co., North Adams, Mass.
PRODUCTION ENGINEERING MEASURE RELIABILITY IMPROVEMENT JET ETCH TRANSISTOR Final Report, Apr. 30, 1962–Mar. 31, 1964
J. N. Edwards, J. H. D. Folster, and R. M. Gagne [1964] 235 p (Contract DA-36-039-SC-86721)
(AD-450503)

This work led to an improved final failure rate of 0.026%/1000 hr from a beginning of 1.4%/1000 hr. This improvement was engendered by production engineering conducted in several areas of jet etch transistor fabrication, including deposition of the gold ring, emitter and collector pit contour, emitter and collector diameter, emitter and collector lead attaching, and collector delineation. This work is described. In addition to studying these areas, two evaluations were made—temperature-sensitive parameters and punch-through limited transistors. The results of these investigations are given. Author

N65-10671# Douglas Aircraft Co., Inc., Long Beach, Calif.
LABORATORY AND FLIGHT EVALUATION OF AIRCRAFT AIRCOOLED WHEEL BRAKES WITH BERYLLIUM HEAT SINK
20 Dec. 1963 71 p refs
(Contract NOw-62-0297-t)
(LB-31550; AD-603758)

Laboratory and aircraft field tests showed the braking system to be feasible and practicable. The aircooling reduced aircraft turn-around time by 65 percent, and the beryllium heat sink provided 19-percent weight saving. Design and cost parameters are established, and consideration for use of a beryllium heat-sink brake is recommended for use on future aircraft. Author

N65-10715# Inland Testing Labs., Dayton, Ohio
RELIABILITY OF MILITARY QUARTZ CRYSTAL UNITS
W. G. Ingling and C. E. Jones *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 289–301 refs (See N65-10701 01-07)

A study of the performance of several types of military quartz crystal units, during long-term oscillation at several drive levels, and during long-term storage at elevated temperatures, is being performed. Six hundred crystal units were procured for evaluation, and were subjected to the preproduction tests of MIL-C-3098C. All crystal units that failed any preproduction tests were discarded. The 574 crystal units remaining after preproduction are being tested for 5000 hours. To date 85 of the 574 crystal units have been listed as "failures." Most of these rejections were because of excessive frequency shifts. The commonest cause of these frequency shifts has been leakage of the crystal holders. Author

N65-10716# Bell Telephone Labs., Inc., Whippany, N.J.
IMPROVEMENTS IN TECHNIQUE FOR THERMO-COMPRESSING MOUNTING WIRES TO QUARTZ CRYSTAL PLATES
J. P. Griffin *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 302–311 (See N65-10701 01-07)

A simple practical method for bonding mounting wires to piezoelectric quartz crystal is described. By using thermocompression methods, fired silver spots and all solder are eliminated. When the attached wires are pulltested to destruction, the wire breaks at 7 1/2 to 9 lb without damage to the bond itself. The attachment is not degraded by any of the solvents commonly used in crystal unit manufacture and will withstand temperatures over the range from 4° K to 700° K. Crystal units made in this way exhibit Q's ranging from two to ten times higher than equivalent conventional units with soldered wires. Over the temperature range from 15° to 70° C the electrical resistance increases only about 25% as compared to 100% for soldered wire units. In +5° X-cut units this resistance improvement is accompanied by a 50% improvement in the temperature-frequency response. A special AT-cut frequency standard crystal prepared in this way showed a frequency aging rate of less than one part per 10^{10} per day beginning with the third day of operation. The tools required consist of a pair of calibrated parallel jaw pliers, a pair of aluminum blocks, and a hot plate. Significant manufacturing savings are envisioned because of lower-headed wire costs, elimination of silver spots, simplified tooling, simplified procedures, and a decreased number of manufacturing rejects for both mechanical and electrical reasons. Author

N65-10718# McCoy Electronics Co., Mount Holly Springs, Pa.
TEMPERATURE TESTING TIGHT TOLERANCE CRYSTAL UNITS
George Bistline, Jr. *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 314–315 (See N65-10701 01-07)

A brief discussion is presented of problems encountered in performing temperature–frequency tests. The rate of temperature change and its influence are described. Author

N65-10719# Systems, Inc., Orlando, Fla.
THE HYBRID-COIL BRIDGE METHOD OF MEASURING UNWANTED MODES OF VIBRATION IN QUARTZ CRYSTALS
W. H. Horton and R. C. Smythe *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 316–324 refs (See N65-10701 01-07)

A hybrid-coil bridge circuit is described that provides a convenient and rapid method of measuring unwanted mode responses. The test circuit is simple to instrument, but requires careful specification of circuit components in order to allow the measurement to be accurately related to the basic crystal property involved. The magnitude of the response of the test circuit to an isolated unwanted mode is determined by a ratio of impedances. In the described circuit, if the change in response of the test circuit to the unwanted modes is small because of the shunting effect of the main mode, the accuracy of the measurement is poor, and an improved technique should be used. P.V.E.

N65-10721# Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
ACHIEVEMENTS AND PROBLEM AREAS OF ATOMIC FREQUENCY CONTROL
F. H. Reder *In its* Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 329–371 refs (See N65-10701 01-07)

An attempt is made to present a brief review of accomplishments during the past 9 years and to provide guidelines for the selection of the proper standard for a specific application, to point out remaining technical problems, and to suggest some improvements. Discussed are the following: (1) masers, lasers, and molecular mm-wave standards; (2) "exotic" maser and

atomic beam schemes; (3) performance of various commercial atomic frequency standards; (4) applications; (5) atomic-beam-tube error sources; (6) passive electronic (beam, cell) error sources; (7) gas-cell-resonator error sources; (8) maser error sources; (9) beam-tube technical problems; (10) technical problems associated with electronic circuits, beam tubes, and H-masers; and (11) time scalers. P.V.E.

N65-10743# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ELECTRODEPOSITION OF SILVER FROM MOLTEN NITRATES

P. V. Polyakov *In its* Nonferrous Met. 29 Jun. 1964 p 108–115 refs (See N65-10737 01-17)

Experiments are conducted on the electrolysis of the melts $KNO_3 + NaNO_3$ with various $AgNO_3$ concentrations, and for the purpose of studying the kinetics of formation of crystal seeds of silver on a platinum microcathode. A linear dependence was established between the number of crystal seeds formed and current density at constant concentration and temperature. Increase in temperature and concentration results in a decrease in the slope of the linear function curve. Author

N65-10746# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

EXTRACTION OF VANADIUM FROM CONVERTER SLAG BY THE METHOD OF CHLORINATION IN THE MELT

S. A. Amirov, V. V. Pech'kovskiy, and R. Kh. Kurmayev *In its* Nonferrous Met. 29 Jun. 1964 p 138–147 refs (See N65-10737 01-17)

The possibility is shown of almost complete recovery of vanadium and titanium from converter slag by chlorination in a medium of molten chlorides of alkaline metals. The extent of vanadium and titanium recovery is established as functions of duration of experiment, temperature, presence of reducing agent, and also of slag particle size, rate and concentration of chlorine fed into the gaseous mixture, and melt composition. The optimal conditions for chlorination of slag in the laboratory experiments were determined: temperature—700° to 800° C; duration of process—90 minutes; and carbon content in the charge—30%. The recovery of vanadium amounted to 97% to 98%; titanium—95% to 96%; silicon—66% to 67%; and iron—20%. In the chlorination of the melt, approximately 80% of the iron remains in the melt. Author

N65-10747# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ELECTRODEPOSITION OF BISMUTH FROM PERCHLORATE SOLUTIONS

V. M. Kochegarov and Ye. A. Zyablov *In its* Nonferrous Met. 29 Jun. 1964 p 148–151 refs (See N65-10737 01-17)

Presented are the results of an investigation of the electrodeposition of bismuth from perchlorate solutions, in which cathode polarization and current-based bismuth yield was studied as a function of concentration of metal, temperature of solution, and current density. Cathode polarization was observed in the separation of bismuth from perchlorate solutions. A possible cause of crystallization polarization in the separation of bismuth is suggested. The composition of the solution and the electrolysis conditions are recommended for obtaining bismuth film on semiconductor surfaces. The solution composition and its recommended conditions are these: 70 to 100 grams/liter $Bi(ClO_4)_3$ and 200 $HClO_4$; current density—2 to 3 A/cm^2 and a solution temperature of 20° C; and soluble anodes (bismuth rods). P.V.E.

N65-10752# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

GALVANIC COPPER-PLATING OF TITANIUM AND ITS ALLOYS

V. V. Usov and V. I. Liner *In its* Nonferrous Met. 29 Jun. 1964 p 180–190 refs (See N65-10737 01-17)

Galvanic copper plating of titanium lowers the transitional resistance, increases electroconductivity and thermoconductivity, and improves the conditions of low-temperature soldering. The copper coat can serve also as a technological lubricant in the cold treatment of titanium by pressure and can protect the surface of articles from scraping and burrs, and thus can significantly improve surface quality. Copper plating of titanium was carried out in a cyanide electrolyte Seignette's salt. The cyanide copper plating conditions were found to be the following: current density—2 A/dm^2 (10 seconds), and then 1 A/dm^2 (10 minutes) at an electrolyte temperature of 40° C. The optimal free cyanide content was 7.5 to 9.5 g/liter. The proposed process for the copper plating gives good results for deformed titanium after rolling and traction (for sheet, wire, and tubular material). P.V.E.

N65-10780# Boeing Co., Seattle, Wash. Aero-Space Div.

MACROLAMINATE PARTICLE COMPOSITE MATERIAL DEVELOPMENT Interim Report, Jun. 1–Aug. 1, 1964

F. H. Simpson and L. M. Stejskal [1964] 27 p
(Contract NOw-64-0194-f)
(IR-2; AD-446630)

Methods of preparing laminate sheets to obtain controlled layer thicknesses were evaluated. Knife coating has been selected as the method to be used for producing the laminate sheet for the macrolaminate particle geometry study. A study of the interrelationship of temperature and pressure used for warm pressing has shown the types of flaws and fracture surfaces produced by the different combinations, and that a pressure of 10 000 psi at 150° F is near optimum. The effect of atmosphere on sintering of the composite and the separate phases by themselves has shown vacuum to produce the greatest degree of ductility in molybdenum, and that highest strength is achieved in composite specimens sintered in wet hydrogen. Vacuum sintering has been selected for investigating the effects and interrelationship of heating and cooling rates, time at maximum temperature, and the maximum temperature. Author

N65-10788# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Aachen (W. Germany) Inst. für Theoretische Gasdynamik

INSTATIONARY HYDRODYNAMIC LUBRICATION THEORY [INSTATIONARE HYDRODYNAMISCHE SCHMIERUNGSTHEORIE]

Ingolf Teipel May 1964 26 p refs *In* GERMAN; ENGLISH summary
(DLR-FB-64-01; DVL-293) Available from DVL, Munich: 11.50 DM

Wearing phenomena were observed in sliding bearings at high rotation velocities. A method was developed that makes it possible to calculate the unsteady loads on a sliding bearing at high reduced frequencies. The results are interpreted in relation to the destruction causes. Author

N65-10794# Battelle Memorial Inst., Columbus, Ohio

A STUDY OF ROTARY SHAFT-SEALING CONCEPTS FOR PRESSURIZED-WATER REACTOR APPLICATION

Daniel R. Grieser, William G. Reider, Lewis E. Hulbert, J. Clarence Bell, John C. Smith et al 30 Jun. 1964 102 p refs Joint U.S.–EURATOM Res. and Develop. Program
(Contract W-7405-ENG-92)
(BMI-1676; EURAEC-1189) OTS: $2.25

. This is a study of mechanical face-type seals and packed-gland-type seals and of their application in pressurized water. Model face-seal experiments revealed the development of a hydrodynamic load support by seal rotation that was sufficient to yield minimum film thicknesses of tens of microinches under light face loadings. The radial distortion of the model-seal components, as a function of applied loading, revealed leakage gaps in which the outer stator edge is 50 to 100 microinches further away from the rotor sealing face than it is from the inner edge. A computer program was developed for the evaluation of distortions of seal designs used in high- and varying-pressure applications. The packed-gland seals were made insensitive to packing loads and sliding velocities by the inverting and skewing of the packing. G.G.

N65-10798# Phillips Petroleum Co., Idaho Falls, Idaho Nuclear Technology Branch
SEPARATION AND PURIFICATION OF A GRAM OF PROTACTINIUM-233
J. W. Codding, J. R. Berreth, R. P. Schuman, W. H. Burgus, and R. A. Deal Sep. 1964 33 p refs
(Contract AT(10-1)-205)
(IDO-17007) OTS: $0.75

One gram (20 000 curies) of pure protactinium-233 has been separated from irradiated thorium and prepared as a sample for neutron cross-section measurements with the MTR Fast Chopper. Development of the process is described. Irradiated thorium was dissolved in nitric–hydrofluoric acid. Separation of protactinium from thorium, uranium, and most fission products was obtained by three successive coprecipitations with MnO_2, each of which carried about 90% of the Pa-233. Manganese was subsequently removed by leaching the final Pa-bearing MnO_2 with dilute nitric acid plus hydrogen peroxide, leaving behind a hydrated Pa oxide, which was then dissolved by prolonged digestion with sulfuric acid. Final recovery was by addition of iodic acid, which precipitated Pa iodate. This was dried and fired at 800° C to Pa_2O_5. Overall Pa-233 recovery was about 50%. Chemical analysis, gamma counting, and neutron absorption measurements showed the absence of thorium, initial uranium, manganese, or other impurities in the final product. Author

N65-10830# AiResearch Mfg. Co., Phoenix, Ariz.
GEM PROPULSION-SYSTEM STUDY Final Report, 30 Nov. 1962–29 Feb. 1964
W. Norgren, G. Perrone, and Y. Senoo 5 May 1964 151 p refs
(Contract Nonr-3024)
(AP-5072-R)

In the previous studies it became clear that the pressure losses in the duct were so significant for ordinary fan-duct systems that to achieve important improvements in total internal efficiency the duct system should be simple and the velocity in the duct must be low. That is, instead of designing a duct system that matches a predetermined fan, an efficient duct-jet system is designed for the particular GEM and a new fan is designed to mate the duct dimensions and aerodynamic performance. The present study effort investigated three areas: (1) design, fabrication, and test of a fan that is suitable for most GEM's; (2) comparative study of base jet-nozzle geometries; and (3) comparison of the pneumatic interconnection between the fan and the base jet nozzles. Author

N65-10839*# Ipsen Industries, Inc., Rockford, Ill.
INVESTIGATION OF FOAMED METALS FOR APPLICATION ON SPACE CAPSULES Annual Report, 29 Jun. 1963–15 Aug. 1964
James Cloud, Landis Lindell, Edward Byrnes, and E. P. Flint 21 Sep. 1964 73 p refs
(Contract NAS8-11048)
(NASA-CR-59515) OTS Prices: HC $3.00/MF $0.75

Investigations of methods of preparing foamed metals in the foamed, sintered state are summarized. Metals included are aluminum, titanium, nickel, 316 stainless steel, H-11 tool steel, and molybdenum. No unusual difficulties are encountered in preparing foams of nickel, 316 stainless steel, H-11 tool steel, and molybdenum, but ductility has not been achieved at densities less than 15 percent of theoretical. Thermal and mechanical properties for the nickel and stainless-steel foams are given. Machining of the foamed metals and methods of brazing them to facing sheets of similar and dissimilar metals are described. Preparation of variable density beams, in which the core material is of a low density and the encasing metal foam is of a relatively high density, can be carried out by one of several methods. Author

N65-10884# Aeroprojects, Inc., West Chester, Pa.
DEVELOPMENT OF ULTRASONIC WELDING EQUIPMENT FOR REFRACTORY METALS Interim Technical Progress Report, Jan.–Mar. 1964
Nicholas Maropis Wright-Patterson AFB, Ohio, ASD, Apr. 1964 25 p refs
(Contract AF 33(600)-43026)
(ASD-TR-7-888(VIII); AD-602663)

Design, development, and construction of the 25-kilowatt spot-type welding machine has continued. Experience gained during the evaluation of ceramic transducer assemblies was used to design a 4.2-kilowatt unit. This assembly incorporates all the modifications previously found desirable to improve the electrical characteristics and facilitate heat removal from the ceramic elements. An extensive study of the test model of the overhung-coupler geometry revealed the factors contributing to its unsatisfactory behavior, and necessary modifications are being made. Assembly of the 25-kilowatt power source was completed and acceptance tests were conducted. The equipment performance was satisfactory. Installation of welder control components on the 25-kilowatt welder frame was completed. Author

N65-10898# Solar, San Diego, Calif.
JOINING OF REFRACTORY METAL FOILS Technical Documentary Report, Jul. 1962–Jul. 1963
J. W. Welty, P. J. Valdez, C. E. Smeltzer, Jr., and C. P. Davis Wright-Patterson AFB, Ohio, ASD, Jul. 1963 205 p refs
(Contract AF 33(657)-9442)
(ASD-TDR-63-799, Pt. I; AD-424651)

Standard methods of welding and brazing refractory metal foils (D36, B66, and TZM) are presented. Electron beam, tungsten inert gas, resistance, and ultrasonic welding techniques are evaluated. Nine selected candidate brazing alloys for these materials were screened by means of T-joint brazements, room-temperature and high-temperature mechanical property tests, and metallographic structure examination. The most promising joining methods for these materials were extended to the fabrication of small honeycomb panels (0.002-in. core, 0.010-in. face sheets) that were block-shear tested at temperatures between 2000° and 2800° F. Author

N65-10905# General Electric Co., Lynn, Mass.
RESEARCH AND DEVELOPMENT OF MATERIALS AND FABRICATION TECHNIQUES FOR THERMOELECTRIC POWER GENERATION Final Report, Jan. 1, 1962–Apr. 1, 1963

10 Dec. 1963 51 p refs
(Contract NObs-86854)
(AD-604997)

A cartridge couple configuration of multiple thermoelectric elements in a hermetically sealed, gas-filled container failed when subjected to operating temperature differentials. The container hot side expanded more than the cold side, resulting in destructive lateral stresses. It was found that the general progress in packing lead tellurides poses the problems of minimization of end constraints, mechanically improved thermoelectric materials, and the minimization of the shunt heat loss and the contact resistance. A feasible method of preparing stoichiometric Mg_3Bi_2 has been developed by the use of a high-pressure, high-temperature bomb technique, in which the magnesium vapor evolved from the melt is retained, and an equilibrium rather than a steady-state evaporation is established. Because of the metallic precipitates in the specimens, few electrical data on the semiconducting properties of the compounds could be obtained. G.G.

N65-10914# Thompson Ramo Wooldridge, Inc., Cleveland, Ohio
DEVELOPMENT OF WELDING PROCEDURES AND FILLER MATERIALS FOR JOINING HIGH STRENGTH LOW ALLOY STEELS Second Quarterly Progress Report, 15 Sep.–15 Dec. 1963
J. M. Faulkner, G. L. Hanna, and J. V. Peck 31 Dec. 1963 54 p refs
(Contract AF 33(657)-11229)
(ER-5708; AD-451219)

Two approaches have been selected: a steel heat treated to obtain 100% bainite and a low carbon steel in which hardening is obtained through a martensite transformation. The materials included in the program are the AMS 6435 grade 4335V in the bainitic condition and HP 9-4-20 (9%Ni, 4%C, 0.2%C) low-carbon steel in the martensitic condition. The isothermal bainite transformation studies of the AMS 6435 plate material have been essentially completed. Austempering for 1 hr at 575° F produced a completely bainitic structure possessing a 0.2% offset yield strength of about 190 000 psi and an ultimate tensile strength of about 237 000 psi with a 58% reduction of area. The heat treatment for the HP 9-4-20 plate consisted of a double temper at 950° F for 2 hours producing a 0.2% offset yield strength of about 190 000 psi and a fracture toughness K_{Ic} value greater than 95 000 psi $\sqrt{in.}$
Author

N65-10946# Battelle Memorial Inst., Columbus, Ohio
THE DEVELOPMENT OF TECHNIQUES TO MEASURE THE DYNAMIC FILM THICKNESS AND FILM PRESSURE IN JOURNAL BEARINGS LUBRICATED WITH LIQUID POTASSIUM Quarterly Progress Report, Feb. 15–May 14, 1964
D. R. Grieser, J. C. Smith, and C. M. Allen 5 Aug. 1964 36 p refs
(Contract AF 33(615)-1134)
(AD-451213)

The program to develop techniques for the static and dynamic measurement of liquid-potassium-lubricated journal-bearing film thickness, film pressure, and film extent has continued. Paper evaluations of a number of potential techniques to accomplish the program objectives were completed, and experimental work was initiated to develop favorable systems. Of the techniques studied, an eddy-current and magnetic-inductance method was selected as being most favorable for the film-thickness measurement. A device based on the Villari effect is being designed for measurement of the potassium-film pressure. Paper evaluations of ultraviolet and radioisotopic radiation techniques for lubricant extent imaging were completed. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N65-10024# Varian Associates, Palo Alto, Calif. Central Research Lab.
COHERENT INFRARED LASER Semiannual Technical Summary Report No. 2, 17 Dec. 1963–16 Jun. 1964
M. W. Muller and A. Sher [1964] 51 p refs
(Contract Nonr-4244(00); Proj. Defender)
(VARIAN-314-2S; AD-603658)

This report is concerned with techniques of obtaining population inversions among vibrational energy levels of molecules using such inversions for the generation of coherent infrared light. The basis for obtaining population inversions is the Frank–Condon principle, and the first molecule under consideration is half-heavy hydrogen HD. Work has been devoted to hydrogen spectroscopy. The development of a discharge tube that has operated satisfactorily over long periods is described. Results of spectroscopic work in the infrared are given. Spectra with high signal-to-noise ratio and resolution have been recorded in the visible to determine population distributions among vibrational levels of hydrogen triplet states. The distributions inferred from these measurements are far from thermal, and some population inversions are observed. These inversions appear smaller than the values predicted by the Franck–Condon principle. The expected intensity distribution of the HD^+ infrared spectrum for a range of temperatures has been evaluated on a computer; these results are presented. Author

N65-10405# Ohio State U. Research Foundation, Columbus Antenna Lab.
STUDY OF MICRON WAVE PROPAGATION Annual Summary Report, 1 Jan.–31 Dec. 1963
1 Jan. 1964 59 p refs
(Contract AF 33(657)-10824)
(Rept.-1579-9; AD-447881)

Factors limiting the transfer of laser radiation from source to receiver are discussed. The mutual coherence function is modified to describe the collimation and focusing capability of a partially coherent source, and calculations of the diffraction patterns of partially coherent circular apertures are made. A suitable criterion for laser-induced atmospheric breakdown is introduced, and nonlinear propagation factors are discussed. The theory of parametric interactions of radiation and matter is generalized. Resonant atmospheric absorption data are summarized for the majority of laser wavelengths. Related activity in laboratory source and instrumentation development is reviewed. Author

N65-10427# Varian Associates, Beverly, Mass. Bomac Div.
HYDROGEN MASER PROGRAM Interim Technical Report, 1 Sep. 1961–1 Jul. 1963

R. Vessot 20 Aug. 1963 83 p refs
(Contract Nonr-357(00))
(AD-422859)

The properties of frequency stability of the hydrogen maser and its application as a time standard, as well as the interaction of the atomic hydrogen with the surface atoms that line the confining bulb, and the interaction of the hydrogen atoms with the Lyman alpha radiation are studied. The following topics are presented: "Hydrogen Handling and Atomic Hydrogen Sources"; "Hydrogen Pumping"; "The Hexapole Magnet Star Selector"; "The Storage Bulb and R.F. Structure"; "Thermal and Magnetic Field Control and Magnetic Shielding"; "The Vacuum Envelope"; "Measurements and Data"; and "Work in Progress." G.G.

N65-10722# Varian Associates, Beverly, Mass.
FREQUENCY BEAT EXPERIMENTS WITH HYDROGEN MASERS
R. F. C. Vessot and H. E. Peters *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 372–391 refs (See N65-10701 01-07)
(Contracts NAS8-2604; Nonr-3570(00))

Data describing the results of comparison measurements made by beating two atomic hydrogen masers are presented. These measurements have indicated that the rms fractional frequency deviations attributable to one maser for various measuring intervals are as follows:

$$1.5\,\text{sec}, 5.6 \times 10^{-12};$$
$$10\,\text{sec}, 1.07 \times 10^{-13}; \text{and}$$
$$1\,\text{hr}, 2.4 \times 10^{-13}.$$

The 1.5-sec and 10-sec measurements are limited by receiver noise, and the 1-hr measurements, by systematic effects due to drifts in the ambient temperature. A description of the apparatus and its control systems are given, and the effect of receiver noise on the calculated stability are discussed. A new smaller version of this device is described, and the possibilities of using the device in a satellite are explored. Author

N65-10725# Technical Research Group, Inc., Syosset, N.Y.
FREQUENCY STANDARDS IN THE OPTICAL RANGE
Gordon Gould *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 425–437 refs (See N65-10701 01-07)

Methods for centering a cw gas-laser oscillation frequency on the fluorescent line have been studied theoretically and experimentally. A piezoelectric crystal has been used to control the cavity length and the oscillation frequency. With a heterodyne detector and feedback circuit one such single-mode He-Ne laser has been frequency locked to another within 3000 cps or better than 1 part in 10^{11}. Several ways of sensing the deviation of the laser frequency from line center have been considered. A very sensitive null indicator is a power-dependent frequency shift that is a linear function of frequency displacement from line center. By power modulating one laser and using a second laser as local oscillator it should be possible to center both within 1 part in 10^{10}. Analysis and experimental results are presented. Author

N65-10728# Naval Observatory, Washington, D.C.
REPORT ON THE FREQUENCY OF HYDROGEN
William Markowitz *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 462–463 (See N65-10701 01-07)

The frequency, ν_H, of a hydrogen maser of the Ramsey type was determined, to the second, of Ephemeris Time during a 2-week interval in May 1963. Values were determined for 10 intervals, averaging 1 day each, with mean epochs from May 12.3 to 23.4, 1963. The probable error of a single determination is ± 0.005 cps, with respect to the frequency system of the Naval Observatory. Three mean values are given, the number of significant figures reflecting the accuracies involved in the reference system. D.S.G.

N65-10907# Aeronutronic, Newport Beach, Calif.
LASER PUMPING SOURCES Final Technical Report
S. Byron, H. Shanfield, W. Lawrence, J. Killian, and D. Peters 15 Jul. 1964 72 p refs
(Contract Nonr-4237(00); ARPA Order 306-62; Proj. Defender) (U-2771; AD-605414)

Successful efforts to overcome the limiting factors associated with adapting explosive light sources to laser pumping are reported. Two modifications were made to the argon flash bomb and involved the following: (1) the use of stationary reflected shock-heated gas as the radiation source; and (2) the use of subatmospheric xenon as the gas to be shock heated. In principle, these changes allow an order of magnitude increase in radiation pulse duration and two orders of magnitude decrease in mass of explosive used; in practice, a radiation pulse was produced over a stationary area of 5 cm^2, having a peak brightness temperature at 5600 Å of 12 300° K, and remaining above 6000° K for 450μ sec, through the use of only 1 g of stored chemical energy. This radiation source was used to stimulate laser action in a neodymium-doped glass rod with no damage to the laser crystal. Other studies of pyrotechnics and explosive–pyrotechnic combinations to produce elevated radiation temperatures indicate that there is a fundamental upper limit of about 5000° K in the visible spectrum range in the radiation intensity that can be achieved directly from high-energy density, chemically reacting systems. M.P.G.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N65-10002# General Dynamics/Fort Worth, Tex.
LONG-TIME INTERMITTENT CREEP Second Quarterly Progress Report, 15 Oct. 1962–15 Jan. 1963
O. N. Thompson and R. L. Jones Jan. 1963 29 p
(Contract AF 33(657)-8907)
(FPR-007; AD-401097)

This program consists of measuring the effects of creep as well as the magnitude of creep resulting from steady and intermittent load application at 550° F and 650° F up to 30 000 hours. The materials under investigation are Ti8Al-Mo-IV, Ti6AL-4V, AM350SCT, and PH15-7Mo stainless steels and René 41 superalloy. This progress report describes the accomplishments to date in preparing for the test using multiple specimen testing on each creep machine. Author

N65-10108# Mellon Inst., Pittsburgh, Pa.
DATA DERIVED FROM REPORT ON METALLURGICAL RESEARCH IN SUPPORT OF THE CONSTRUCTION AND TESTING OF A 10 FT. DIAMETER PROTOTYPE PRESSURE VESSEL USING MARAGING 18 PERCENT NICKEL STEEL PLATES
G. K. Bhat and W. J. Persin 22 Apr. 1963 *In* Lockheed Propulsion Co. Design, Fabric., and Hydrotesting of a 120-Inch Diameter Pressure Vessel Using 18 Percent Ni Maraging Steel 2 Oct. 1964 31 p refs Prepared for Lockheed Propulsion Co. (See N65-10107 01-32)

This report presents physical and mechanical property data, including fracture toughness evaluation data for heavy gage plates of maraging 18% nickel steel. It also includes results of some preliminary weldability, welding process development, weld microstructure, and weld-joint-efficiency evaluation studies conducted on the above steel plates. Author

N65-10109# Mellon Inst., Pittsburgh, Pa.
METALLURGICAL ANALYSIS OF FRACTURED CLOSURE PLATE OF THE 120-INCH MARAGING STEEL PROTOTYPE VESSEL Final Report
G. K. Bhat 15 Sep. 1963 *In* Lockheed Propulsion Co. Design, Fabric., and Hydrotesting of a 120-inch Diameter Pressure Vessel Using 18 Percent Ni Maraging Steel 2 Oct. 1964 75 p refs Prepared for Lockheed Propulsion Co. (See N65-10107 01-32)

The metallographic and mechanical strength data have led to the belief that delamination of the plate welded to the ring forging is largely responsible for the failure of the closure plate at around half the designed membrane stress. The delamination itself seems to have been triggered by the yielding of the retained austenite and cracking of carbides and nitrides in the banded areas of the plate, leading to the formation of a chain of small cracks followed by interplanar separation in the plate. Despite the delamination problems, the maraging 18Ni steel of 250-ksi strength level used in the construction of large diameter booster cases promises to be the best candidate material. Author

N65-10206# Battelle Memorial Inst., Columbus, Ohio Defense Metals Information Center
THE STATUS AND PROPERTIES OF TITANIUM ALLOYS FOR THICK PLATE
G. E. Faulkner, W. J. Lewis, and D. C. Martin 14 Jun. 1963 53 p refs
(Contract AF 33(616)-7747)
(DMIC-185; AD-421029)

For the application of thick titanium plate in submarine hulls, a minimum tensile yield strength of 120 000 psi and a minimum Charpy V-notch energy value of 20 foot-pounds at −80° F are desired, in a weldable alloy. Alloys meeting these requirements would be equally useful in other thick-plate structures. Two commercial titanium alloys of the alpha type (Ti-5Al-2.5Sn and Ti-8Al-2Cb-1Ta), one commercial alpha-beta alloy (Ti-6Al-4V), and one beta alloy (Ti-13V-11Cr-3Al) meet the yield strength requirements of 120 000 psi in the form of annealed plate. Plates of the two alpha alloys and of the alpha–beta alloy have also shown a Charpy V-notch impact energy level of 20 foot-pounds at −80° F, as have welds in thick-plate specimens of these alloys. The 8Al-2Cb-1Ta composition has not proved to be weldable without cracking problems, but plate specimens with the composition altered to Ti-7Al-2Cb-1Ta welded with filler metal of Ti-6.5Al-2Cb-1Ta have been welded without cracking. Author

N65-10217# Solar, San Diego, Calif.
EVALUATION OF RMSP TUNGSTEN SHEET Quarterly Progress Report No. 4, 1 Apr.–31 Jun. 1964
F. St. Germain and M. R. Licciardello 15 Jul. 1964 85 p refs
(Contract NOw-63-0786-d)
(ER-11399-4; AD-603542)

Tensile tests using radiant heating methods on similar test specimens that were previously evaluated by resistance heating were completed. The radiant heating tensile test results did not show any appreciable changes in ductility between individual sheet gages when comparing both test methods at comparable temperatures. The chemical analysis conducted on a number of resistance-heated tungsten-sheet tensile specimens, which exhibited low elongation values, indicated that material contamination was not the major factor in causing the low ductility in RMSP tungsten sheet. The determination of the formability behavior of RMSP tungsten sheet using a variety of shop processes was continued. Forming parameters using the various sheet gages were developed for brake forming, joggling, corrugating, dimpling, deep drawing, and roll forming. The results of the formability studies indicate that tungsten sheet can be formed by each of the forming techniques, provided close control of forming procedures, sheet temperatures, and suitable tooling are utilized. Author

N65-10316# Thompson Ramo Wooldridge, Inc., Cleveland, Ohio Electromechanical Div.
CURRENT ADVANCES IN PROTECTIVE COATINGS FOR REFRACTORY METALS AT TRW
J. D. Gadd and R. A. Jefferys 18 Aug. 1964 46 p Presented at the 9th Meeting of the Refractory Composites Working Group, Worcester, Mass., 18–20 Aug. 1964
(Contracts AF 33(657)-7396; AF 33(615)-1525; AF 33(657)-11151; NOw-63-0471-c)
(TM-3992)

The Cr-Ti-Si diffusion alloy coating for the protection of niobium- and tantalum-base substrates is discussed in terms of process development, reliability studies, and reduced-pressure oxidation studies. Comparative mechanical property data were generated for four coating–niobium-base-metal systems for a design data study; the TRW Cr-Ti-Si coating and the Pfaudler single-cycle modified silicide coating were comparatively evaluated on 30 mil D-43 and B-66 alloy sheet. Tables and photographs show examples of niobium-alloy components to which the Cr-Ti-Si diffusion alloy coating was applied by the vacuum-pack process. Two coating systems for tungsten were developed and evaluated. These systems are silicon–tungsten, and titanium + zirconium + silicon–tungsten, and are applied to tungsten by the vacuum-pack process. Silicon and tungsten are codeposited, and titanium and zirconium are deposited in separate steps. Preliminary work on developing an oxidation-resistant coating for TD nickel is reported; a chromium–aluminum–nickel diffusion alloy coating appears highly promising. R.L.K.

N65-10322# Watervliet Arsenal, N.Y. Benet R & E Labs.
THE EFFECT OF FERRITE ON THE MECHANICAL PROPERTIES OF A PRECIPITATION HARDENING STAINLESS STEEL
Vito J. Colangelo May 1964 46 p refs
(WVT-11-6404; AD-603949) OTS: $1.25

The primary object of this study was to determine the effect of ferrite and its orientation upon the mechanical properties of a precipitation hardening stainless steel with particular attention to the short transverse properties. The investigation consisted of four major parts: the preliminary investigation of billet properties, the effect of forging reduction

and ferrite content upon mechanical properties, the effect of notch orientation upon impact strength, and the relationship of heat composition to ferrite content. Author

N65-10359# University Coll., Cardiff (Gt. Brit.)
IRON-CHROMIUM-NITROGEN ALLOYS Quarterly Technical Status Report, 1 Dec. 1963–31 Mar. 1964
R. Rawlings and G. Ll. Richards [1964] 4 p refs
(Contract DA-91-591-EUC-2863)
(QTSR-3; AD-442876)

Sheet specimens 0.010 in. thick were nitrided at 700° C for up to 160 hr and quenched into water at room temperature. Thin foils suitable for examination in the electron microscope were prepared from the sheet specimen. Little evidence of nitride precipitate was observed in the thin foils. From the transmission-electron-microscopy results, it appears either that insufficient nitrogen was introduced into the ferrite at 700° C or the time at this temperature was too short to allow precipitation of chromium nitride to occur. The internal friction of wires nitrided under the same conditions as the strip specimens used for electron microscopy was of the order of 0.0005, and the peak heights were very small. D.E.W.

N65-10407# Naval Research Lab., Washington, D.C. Metallurgy Div.
THE EFFECT OF A FATIGUE CRACK ON THE NOTCH STRENGTH AND FRACTURE DEVELOPMENT IN CYLINDRICAL SPECIMENS OF HEAT-TREATED 4340 STEEL
E. P. Klier 24 Jun. 1963 16 p refs
(NRL-5914; AD-414823) OTS: $0.50

As the notch root radius in the notch-tension specimen is reduced, a limit is reached beyond which sharper machined notches are not feasible. Sharper notches, potentially, can be formed by fatigue action. The fatigue notches have a flank angle of effectively zero, but the notch root radius is from two to three orders of magnitude less than that for the machined notches. It is important to know the effect of a fatigue notch on the notch strength of a steel, which in the present work was a 4340 steel, heat-treated to characteristic strength levels. Fatigue-cracked specimens for the various heat-treated conditions were tested in static tension at temperatures from 75° to −323° F to establish notch-strength transitions. The notch strengths measured with the fatigue-cracked specimens demonstrate that the notch formed in fatigue is more severe than the sharpest machined notches. The ductile–brittle transition measured with 0.5-in. cylindrical fatigue-cracked specimens occurs at higher temperatures than that for comparable 1.5-in cylindrical specimens with the sharpest machined notches. Fracture appearance transitions were also established from examination of the fracture facets, and the data obtained have been compared with the NDT temperature measurements for a similarly heat treated steel that were reported by Puzak. The fatigue-notch tension data yield fracture indices of brittle behavior that parallel but, are not equal to the NDT index measured in the drop-weight tests reported by Puzak. Author

N65-10425# Naval Research Lab., Washington, D.C. Metallurgy Div.
ILLUSTRATED GLOSSARY OF FRACTOGRAPHIC TERMS. SECTION 2: GLIDE PLANE DECOHESION SERPENTINE GLIDE, RIPPLES, STRETCHING, MICROVOID COALESCENCE
C. D. Beachem and D. A. Meyn Jun. 1964 57 p refs
(NRL-Memo-1547; AD-603777) OTS: $3.00

The various fracture surface features formed by fine-scale plastic flow processes are discussed, and the mechanisms by which they are formed are discussed where they are known. Glide plane decohesion, as it has been used in the literature, is shown to be misleading, and a more descriptive term, "stretching," is used in its place. The use of "ductile cleavage" to describe the same process should be discontinued. The use of specific plastic flow mechanisms, such as cross-slip, twinning, wavy slip, pencil glide, and multiple slip to describe mechanisms responsible for the production of fracture surfaces should be reserved for those cases where the specific mechanism has been definitely established for a specific region of a specific fracture surface. Glide plane decohesion, serpentine glide, ripples, stretching, and three kinds of microvoid coalescence are shown to be parts of plastic rupture. Author

N65-10439# Naval Research Lab., Washington, D.C. Metallurgy Div.
MECHANICAL PROPERTIES AND ELECTRICAL RESISTIVITY OF THE HEXAGONAL Ag-Al INTERMETALLIC PHASE
G. Sandoz Jul. 1964 49 p refs
(NRL-Memo-1544; AD-603543) OTS: $3.00

The mechanical properties and electrical resistivity of a number of alloys within the composition range of the Ag-Al hexagonal intermediate phase were determined. All the alloys were extruded to rod, swaged, and finally annealed at either 850°, 600°, or 400° F and quenched. The series of alloys annealed at 850° F spanned the composition range from 26 to about 40 at.% Al; the other series ranged from 32 to 40 at.% Al. The results show that the binary alloys annealed at 400° F are strongest; tensile strengths of about 100 000 psi and yield strengths of about 85 000 psi were obtained. The elongation and reduction in area of the binary alloys remained fairly constant at 12% to 18% in all the alloys containing less than about 35 at.% Al. With greater amounts of Al the alloys became less ductile, particularly the alloys annealed at 850° F. Author

N65-10453# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.
INFLUENCE OF CONSTITUENT PARTICLES ON FATIGUE CRACK PROPAGATION IN ALUMINUM ALLOYS
Regis M. N. Pelloux Sep. 1963 42 p refs
(DI-82-0297; AD-423026)

The fracture surfaces of two controlled chemistry 7178 aluminum alloys, containing a volume fraction of inclusions of 0.38% and 4.78%, were studied by electron microscopy. Local crack propagation in the matrix, as determined by measurement of spacing of crack arrest lines, was observed to be slower than the overall crack growth. This difference is shown to be due to extensive cracking of brittle second-phase particles ahead of the main crack. The extent of this cracking is shown to depend on the size of the plastic zone at the crack tip and interparticle spacing. Author

N65-10456# Los Alamos Scientific Lab., N. Mex.
AN ELECTRON-MICROGRAPHIC STUDY OF ALPHA PLUTONIUM FRACTURE SURFACES
S. E. Bronisz and Dana L. Douglass 19 Oct. 1964 42 p refs
(Contract W-7405-ENG-36)
(LA-3140-MS) OTS: $1.00

The fracture behavior of alpha plutonium has been studied using electron microfractography. Standard techniques were employed for producing the highly contaminated replicas, and they were handled using techniques previously worked out for handling alpha radioactive metallographic specimens. For high-purity alpha plutonium, the fracture mode is temperature dependent with an equicohesive temperature between 191° and

297° K. Below this temperature, alpha plutonium fractures in a ductile, transgranular manner, above it, fractures are intergranular. The appearance of the fracture surface is modified by the presence of impurities. Author

N65-10463# Rensselaer Polytechnic Inst., Troy, N.Y. NASA Interdisciplinary Materials Research Lab.
THE MICROSTRUCTURE AND DISLOCATION DEFORMATION STRUCTURE OF SEVERAL DISPERSION-STRENGTHENED AL-AL_2O_3 SAP-TYPE ALLOYS
R. S. Goodrich, Jr. and G. S. Ansell 23 Aug. 1963 197 p refs
(Contract Nonr-591(15))
(TR-4; AD-416433)

The microstructure of several typical recrystallized Al-Al_2O_3 SAP-type alloys was studied, using transmission electron microscopy. The microstructure of these alloys consists of small (650- to 950-Å mean diameter) plate-shaped alumina particles finely distributed in an aluminum matrix. The work-hardening characteristics and dislocation configurations of several recrystallized Al-Al_2O_3 SAP-type alloys, subjected to both tensile and rolling deformation, were studied by transmission electron microscopy. It was found that rolling deformation of two alloys produced a rapid buildup of heavily tangled and jogged dislocation structure. Tensile deformation studies on one alloy revealed no cell-structure formation, but instead, a more uniform distribution of heavily tangled and jogged dislocations was produced. D.E.W.

N65-10476# Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
PRINCIPLES OF MAGNETOHEAT TREATMENT OF STEEL
Roman Skorski 22 Sep. 1964 36 p refs Transl. into ENGLISH from Prace Inst. Mech. Precyzyjnej (Warsaw), v. 9, no. 34, 1961 p 37–50
(RSIC-279; AD-607390)

This is a study of the magnetoheat treatment of steel and steel alloys. Nickel and iron wires of various diameters and lengths, which had been placed in various fields of magnetic intensity, were studied by oscillogram. The change in the intensity of the magnetic flux was mechanically polarized along a helical line along the wire axis. The following studies are presented: the mechanomagnetic and electromagnetic effects and their role in the magnetoheat treatment of steel, and the formation of fine grain in steel as a result of annealing in a magnetic field. G.G.

N65-10486# American Machine and Foundry Co., Alexandria, Va.
COATED REFRACTORY METAL EMITTANCE SPECIMENS Technical Documentary Report, May 1, 1963–Feb. 29, 1964
H. W. Leavenworth, Jr., E. A. Schatz, M. E. Browning, and F. J. Dunkerley Wright-Patterson AFB, Ohio, AF Materials Lab., Aug. 1964 65 p refs
(Contract AF 33(657)-11330)
(ML-TDR-64-148; AD-607530)

Four columbium-base alloys were coated with oxidation-resistance coatings by four different industrial organizations and measured for thermal radiation and other general physical properties at 1520° F. Basic acceptance data obtained for these four coated columbium-base alloys included photomicrographs of the coatings before and after a 6-hour stability test, physical observation of the stability of the coatings at 2500° F at hourly intervals to a maximum of 6-hours, surface roughness measurements, and such thermal optical data as total normal emittance, spectral emittance, and spectral reflectance. Author

N65-10504# Northwestern U., Evanston, Ill. Technological Inst.
STRUCTURE AND PROPERTIES OF SOLID SOLUTIONS Final Report, 1 Jun. 1958–30 Jun. 1964
Morris E. Fine [1964] 35 p refs
(Contract Nonr-1228(11))
(AD-601520)

This paper covers the studies of general solid-solution strengthening in face-centered-cubic metals due to the interaction of moving dislocations with solute atoms. The rate of solution hardening in face-centered-cubic metals was found to be, initially, most rapid and to decrease with the rising solute content, except in NaCl structured compounds. Since the electrons in metals are not localized, the introduction of any solute in the energy-band structure caused a disturbance. It was concluded that the strain energy and the modulus effects are not the principal source of strengthening in metals. G.G.

N65-10517# Battelle Memorial Inst., Columbus, Ohio Defense Metals Information Center
EXPLOSIVE FORMING OF METALS
D. E. Strohecker, R. J. Carlson, S. W. Porembka, Jr., and F. W. Boulger 8 May 1964 64 p refs
(Contract AF 33(615)-1121)
(DMIC-203; AD-605372)

Explosive-metalworking operations can generally be classified as either confined or unconfined systems. The confined system has distinct advantages for the forming of thin materials to close tolerances; however, the nature of the operation imposes a size limitation. Unconfined systems are less efficient because only a small portion of the total energy from the explosive is utilized in the forming operation. This method is particularly attractive, especially for very large pieces, since tooling requirements are greatly simplified. A wide variety of explosives and detonators used in explosive-forming operations are discussed, with emphasis on the secondary high explosives. Both commercial and military types of explosives have been used in forming operations to date. Characteristics of these materials relating to their handling and storage are briefly reviewed. The versatility and wide use of Primacord in explosive operations are particularly noteworthy. Author

N65-10524# Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
ABOUT THE STRESS DISTRIBUTION IN ELECTRIC RESISTANCE WELDING JOINTS IN THIN SHEET METALS
Franz Bollenrath 7 Oct. 1964 14 p refs Transl. into ENGLISH from the book "Deutsche Versuchsanstalt für Luftfahrt Jahrbuch" Berlin, Jan. 1937 p 303–307
(RSIC-297; AD-607394)

On three models made from Trolon the edge stresses are determined by means of the photoelastic method for simplified conditions of resistance-welded joints of overlapped sheet metals of equal thickness The stress maxima have been found at the edge of the seam; they are 5.43 times the mean stress in the metal for the single single-shear joint and 1.75 times for the single double-shear joint and 4.3 times for the single-shear double joint. Fatigue ruptures of spot-welded joints start from positions where, according to stress measurements, the greatest pulling stresses occur. Author

N65-10580# Lockheed Missiles and Space Co., Sunnyvale, Calif. Materials Sciences Lab.
RECOVERY BEHAVIOR OF PURE ALUMINUM AND SELECTED BODY-CENTERED CUBIC METALS Technical Documentary Report, 1 Mar. 1963–30 Mar. 1964

J. L. Lytton, K. H. Westmacott, and L. C. Potter Wright-Patterson AFB, Ohio, AF Mater. Lab., Aug. 1964 62 p refs
(Contract AF 33(657)-10281)
(ML-TDR-64-189; AD-607258)

The flow-stress recovery of high-purity aluminum, unalloyed sintered molybdenum, Mo-1 wt.% W, and electron-beam-melted columbium following a tensile prestrain was studied in terms of a fractional flow-stress-recovery parameter f_r. The flow-stress-recovery behavior was related to the dislocation rearrangements that were studied by using transmission electron microscopy for aluminum and columbium and etch-pit techniques for molybdenum. Author

N65-10620# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.
THE DEFORMATION OF Cu_3Au AT ELEVATED TEMPERATURES
Martin J. Balckburn Aug. 1963 39 p refs
(D1-82-0301; AD-423115)

The variation of mechanical properties in Cu_3Au were investigated over the temperature range 25° to 550° C using constant strain rate and constant stress tests. The yield stress of the ordered alloy has been found to be temperature dependent reaching a maximum near the critical temperature T_c. The dislocation arrangements in deformed specimens were investigated by transmission electron microscopy. A predominance of screw-type superdislocations has been observed at all temperatures below T_c, these dislocations tending to become longer and straighter as the test temperature approaches T_c. At temperatures above T_c little tendency to cell formation has been observed. An attempt is made to correlate the observed microstructure with the changes in mechanical properties. Author

N65-10636*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
METALLURGICAL BONDING OF PLASMA-SPRAYED TUNGSTEN ON HOT MOLYBDENUM SUBSTRATES
William A. Spitzig and Salvatore J. Grisaffe Washington, NASA, Nov. 1964 9 p refs
(NASA-TN-D-2510) OTS Prices: HC $0.50/MF $0.50

Metallurgically bonded plasma-sprayed tungsten was applied to metallographically polished and preheated molybdenum substrates. The substrates were preheated to 1750° F or higher immediately before spraying. The preheating and the spraying operations were performed in a nitrogen atmosphere. Metallurgical bonding occurred when the preheated substrate temperature was between 2200° and 3700° F. At these temperatures, the molybdenum substrates completely recrystallized even though the total time for preheating, spraying, and cooling to 400° F was only about 30 seconds. Cross sections of coating and substrate indicate that the coating-to-substrate bond was the result of substrate grains growing into the coating. Author

N65-10637*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
INFLUENCE OF CRYSTAL STRUCTURE ON FRICTION CHARACTERISTICS OF RARE-EARTH AND RELATED METALS IN VACUUM TO 10^{-10} MILLIMETER OF MERCURY
Donald H. Buckley and Robert L. Johnson Washington, NASA, Nov. 1964 18 p refs
(NASA-TN-D-2513) OTS Prices: HC $0.50/MF $0.50

The friction, wear, and metal-transfer characteristics were determined for rare-earth and related metals in vacuum to 10^{-10}mm of mercury. The metals studied were lanthanum, neodymium, praseodymium, cerium, holmium, erbium, gadolinium, dysprosium, samarium, yttrium, and thallium. Friction and wear experiments were conducted with the rare-earth or related metals generally sliding against 440-C stainless steel at sliding velocities to 2000 ft/min and loads to 3000 grams. The rare-earth or related metals were the rider specimens (3/16-in.-rad. hemisphere) sliding on flat 2 1/2-in.-diam disk specimens of 440-C stainless steel. Factors studied were the effects of crystal structure and crystalline phase changes on the friction, wear, and metal-transfer characteristics of these metals in vacuum. Author

N65-10666# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
MECHANICAL AND PHYSICAL PROPERTIES OF SUPER ALLOY AND COATED REFRACTORY ALLOY FOILS Fifth Quarterly Progress Report, 15 May 1963–15 Aug. 1964
Guy V. Bennett Sep. 1964 209 p refs
(Contracts AF 33(657)-11207)
(SM-44631; AD-442734)

The following studies of the mechanical and physical properties of super alloys and coated refractory alloys were made: "Material"—the specimen preparation and fabrication, and the coatings for refractory alloys; "Equipment Status"—the extensometer, temperature measurements, and the current status of work; "Test Results"—the superalloy testing for tensile strength, fatigue, creep rupture, thermal cycling, metallographic structures, and heat capacity; also tensile tests of coated refractory alloys and bare refractory alloys. G.G.

N65-10690# Battelle Memorial Inst., Columbus, Ohio
SURVEY OF CURRENT KNOWLEDGE OF METAL DEFORMATION PROCESSING AND DEFORMATION CHARACTERISTICS OF BERYLLIUM, REFRACTORY METALS, SUPERALLOYS, AND HIGH-STRENGTH STEELS, AND OTHER DIFFICULT-TO-FORM METALS Final Report, May 13, 1963–Jun. 13, 1964
14 Aug. 1964 299 p refs
(Contract N600(19)-60240)
(AD-446229)

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3. THERMAL MECHANICAL VARIABLES AFFECTING THE PROPERTIES OF REFRACTORY METALS AND ALLOYS J. A. Houck and H. R. Ogden p 149–174 refs (See N65-10693 01-17)
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5. DEVELOPMENT OF PREFERRED ORIENTATIONS A. R. Rosenfield p 211–223 refs (See N65-10695 01-17)
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N65-10691# Battelle Memorial Inst., Columbus, Ohio
EXTRUSION
F. W. Boulger and D. E. Strohecker *In its* Surv. of Current Knowledge of Metal Deformation Process. and Deformation Characteristics of Beryllium, Refractory Metals, Superalloys, and High-Strength Steels, and Other Difficult-to-Form Metals 14 Aug. 1964 p 1–80 refs (See N65-10690 01-17)

A description of the principles, limitations, and effects of extrusion processes is given. Specifically discussed are the following: (1) hydrostatic extrusion; (2) factors affecting extrusion pressures, such as strength and reduction, friction and die shape, strain rate, and temperature distributions; (3) extrusion equipment and tooling; (4) lubrication for cold extrusion, hot extrusion, and for claddings; (5) metal flow in extrusion and effects of lubrication, extrusion ratio, and conical dies; and (6) effect of extrusion conditions on microstructure and mechanical properties. D.S.G.

N65-10692# Battelle Memorial Inst., Columbus, Ohio
FORGING
F. W. Boulger and A. M. Sabroff *In its* Surv. of Current Knowledge of Metal Deformation Process. and Deformation Characteristics of Beryllium, Refractory Metals, Superalloys, and High-Strength Steels, and Other Difficult-to-Form Metals 14 Aug. 1964 p 81–148 refs (See N65-10690 01-17)

A general description of the various forging processes is presented. The types of forging operations include open-die and closed-die, hydrodynamic compressive, and incremental. Forging equipment is characterized on the bases of the types of shape changes they can produce and of their deformation rates; hammers, upsetters, presses, and specialized equipment are described. Also discussed are these: (1) plastic deformation produced by forging operations; (2) limits and restraints of the processes; (3) forging parameters, including friction and lubrication, die roughness, temperature, strain rate, and forging loads; and (4) influence of forging on the mechanical properties of the metals. D.S.G.

N65-10693# Battelle Memorial Inst., Columbus, Ohio
THERMAL MECHANICAL VARIABLES AFFECTING THE PROPERTIES OF REFRACTORY METALS AND ALLOYS
J. A. Houck and H. R. Ogden *In its* Surv. of Current Knowledge of Metal Deformation Process. and Deformation Characteristics of Beryllium, Refractory Metals, Superalloys, and High-Strength Steels, and Other Difficult-to-Form Metals 14 Aug. 1964 p 149–174 refs (See N65-10690 01-17)

In the study of thermal mechanical effects on refractory materials, distinction is made between pure metals, or solid-solution alloys, and alloys containing dispersed phases. The effects on the latter alloys are more complex, since intermediate recrystallization anneals do not completely remove the effects of prior fabrication on the dispersion size and distribution. Data are presented illustrating effects of thermal mechanical variables on the mechanical behavior of the refractory metals columbium, tantalum, molybdenum, and tungsten, and their alloys. It is concluded that the factor having the greatest influence is the amount of strain hardening following the last recrystallization anneal. The wrought structures are stronger, and, also, their ductile-to-brittle transition temperatures are generally lower than for recrystallized or equiaxed structures. D.S.G.

N65-10694# Battelle Memorial Inst., Columbus, Ohio
ROLLING
William Marsh Baldwin, Jr. *In its* Surv. of Current Knowledge of Metal Deformation Process. and Deformation Characteristics of Beryllium, Refractory Metals, Superalloys, and High-Strength Steels, and Other Difficult-to-Form Metals 14 Aug. 1964 p 175–210 refs (See N65-10690 01-17)

During the rolling process, the metal strip does not deform homogeneously; inhomogeneities of flow occur in the rolling direction, the transverse direction, and the normal direction, and will tend to cancel each other in some cases and augment each other in other cases. Approximations that characterize the interplay of stresses during rolling are proposed to rationalize and predict in a qualitative way the effects to be found and expected in the rolling process. Also discussed are the following: (1) problems raised by succession of rolling phases; (2) the effect of impurities on cold rolling; (3) rolling at elevated temperatures; and (4) the effect of impurities on hot rolling. D.S.G.

N65-10695# Battelle Memorial Inst., Columbus, Ohio
DEVELOPMENT OF PREFERRED ORIENTATIONS
A. R. Rosenfield *In its* Surv. of Current Knowledge of Metal Deformation Process. and Deformation Characteristics of Beryllium, Refractory Metals, Superalloys, and High-Strength Steels, and Other Difficult-to-Form Metals 14 Aug. 1964 p 211–223 refs (See N65-10690 01-17)

Preferred orientations in metals exist because they are crystalline, and many of their properties depend upon the crystallographic direction in which they are measured. This directionality arises because atomic arrangements are different on different crystallographic planes and directions, and because interatomic forces may also vary with direction. Two types of anisotropy are considered—deformation anisotropy, and growth anisotropy occurring during solidification or recrystallization. Factors affecting preferred orientations or "textures" are discussed, including mechanical and physical constraints in the development of deformation textures, and mechanisms in the development of annealing textures. D.S.G.

N65-10696# Battelle Memorial Inst., Columbus, Ohio
ANISOTROPY OF STRENGTH AND DUCTILITY
A. H. Clauer *In its* Surv. of Current Knowledge of Metal Deformation Process. and Deformation Characteristics of Beryllium, Refractory Metals, Superalloys, and High-Strength Steels, and Other Difficult-to-Form Metals 14 Aug. 1964 p 224–248 refs (See N65-10690 01-17)

The extent to which texture can influence such properties as strength and ductility depends not only on the degree and type of texture present but also on the degree of anisotropy of deformation of single crystals of the particular metal. Both the effects of orientation on the tensile properties of single crystals and how these properties are changed when the crystal is imbedded in a polycrystalline aggregate must be known before the influence of preferred orientation on the mechanical properties of metals can be understood. This report discusses the following: (1) the outstanding aspects in anisotropy in strength and ductility in hexagonal close-packed, face-centered-cubic, and body-centered-cubic metals; (2) where these characteristics may be used to advantage; and (3) how information gained from single crystals can give insight into the directional mechanical properties of polycrystalline materials having a preferred orientation. D.S.G.

N65-10697# Battelle Memorial Inst., Columbus, Ohio
HIGH-STRAIN-RATE DEFORMATION
Mark J. Klein *In its* Surv. of Current Knowledge of Metal Deformation Process. and Deformation Characteristics of Beryllium, Refractory Metals, Superalloys, and High-Strength Steels, and Other Difficult-to-Form Metals 14 Aug. 1964 p 249–265 refs (See N65-10690 01-17)

The theoretical approaches being used to study the response of metals to variations in rates of deformation are surveyed. The strain-rate spectrum is outlined, and regions of major interest are discussed. Deformation at different strain rates is divided into three parts: (1) deformation below the relativistic velocity range; (2) deformation at velocities where relativistic effects become significant; and (3) deformation

above the relativistic velocity range. Equations are presented in areas where they may be useful in material-response prediction. D.S.G.

N65-10698# Battelle Memorial Inst., Columbus, Ohio
STRAIN AGING
M. J. Klein and C. N. Reid *In its* Surv. of Current Knowledge of Metal Deformation Process. and Deformation Characteristics of Beryllium, Refractory Metals, Superalloys, and High Strength Steels, and Other Difficult-to-Form Metals 14 Aug. 1964 p 266–293 refs (See N65-10690 01-17)

Two general types of strain aging are recognized: (1) static strain aging, which is the segregation of solute atoms at stationary dislocations after deformation; and (2) dynamic strain aging, which is the segregation of impurity atoms at moving dislocations during deformation. Dynamic strain aging is particularly important in the metalworking industry because of the great changes in strength and ductility induced by this type of aging during fabrication. Static strain aging is also discussed since, from a fundamental approach, the two types of aging cannot be satisfactorily divorced. The various theories of strain aging are reviewed, and their ability to explain and predict property changes are compared with experimental data. D.S.G.

N65-10737# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NONFERROUS METALLURGY
29 Jun. 1964 211 p refs Transl. into ENGLISH of Izv. Vysshikh Uchebn. Zavedenii, Tsvet. Met. (Ordzhonikidze), no. 4, 1963 p 1–151
(FTD-MT-64-15; AD-604343)

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N65-10738# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CALCULATION OF SURFACE TENSION OF MOLTEN HALOGENIDES AT INTERFACE WITH INERT PHASE AT MELTING POINT
O. K. Sokolov *In its* Nonferrous Met. 29 Jun. 1964 p 66–74 refs (See N65-10737 01-17)

It is shown that the surface tension of molten halogenides at the boundary with the inert phase is determined by the force of interaction between the ions of the coordination itself, as well as of ions of adjacent coordinations per unit path. An equation is derived for calculation of the surface tension

of molten halogenides at the boundary with the inert phase for the melting point, and good agreement is shown between the experimental and the calculated data. Author

N65-10739# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DIFFUSION KINETICS OF THE DISSOLUTION OF COPPER, NICKEL AND IRON IN MOLTEN METALS
P. M. Shurygin and V. D. Shantarin *In its* Nonferrous Met. 29 Jun. 1964 p 75–82 refs (See N65-10737 01-17)

The method of dissolution from an equally accessible surface was used to measure the dissolution rates and the diffusion coefficients of copper in liquid zinc, cadmium, tin, antimony, lead, and bismuth, and also of iron and nickel in molten copper. It was found that the energy of activation of the diffusion process in the metals studied ranged from 5.8 to 11.6 kj/mole, and are uniformly lowered with increase in copper solubility. The diffusion coefficients are of the order of 10^{-5} cm^2/sec, and the values of the preexponential factors for iron and nickel in their diffusion in copper exceeds by 10-fold the corresponding values in the diffusion of copper in fusible metals. The qualitative applicability of ideas developed for diffusion in the solid state is shown for liquid metals, and an attempt is made to explain the results obtained from the vantage point of the whole structure of liquids. Author

N65-10740# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ANODE POLARIZATION OF SILICON IN THE COPPER-SLAG SYSTEM
G. A. Toporishchev, O. A. Yesin, and V. N. Kalugin *In its* Nonferrous Met. 29 Jun. 1964 p 83–92 refs (See N65-10737 01-17)

The commutator method at 1200° to 1500° C for various cell constructions was used to establish that the anodic transition of silicon from copper to slag under the conditions studied is inhibited by its delayed diffusion in the metal. It is shown that the anodic dissolution of silicon occurs chiefly in the form of the bivalent ion. Author

N65-10741# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EFFECT OF EXTENT OF ROASTING OF COPPER-ZINC CONCENTRATES ON THE RESULTS OF SMELTING OF CINDERS
V. I. Smirnov, A. P. Doroshkevich, and Yu. A. Yablonskiy *In its* Nonferrous Met. 29 Jun. 1964 p 93–98 refs (See N65-10737 01-17)

Experiments involving the smelting of roasted concentrates were conducted in order to study the influence that the extent of roasting of sulfide materials has on the distribution of the main metals (copper and zinc) between slag and matte. Smeltings conducted indicated that the smelting of fluxed cinders with low sulfur content of 8.5% to 10.5% or of 6% total sulfur in the charge results in rich matte with a high copper content. Smelting of cinders with a high sulfur content afforded production of matte containing 40% to 55% Cu. P.V.E.

N65-10742# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THEORY OF THREE-LAYER CONTINUOUS CONVERSION OF COPPER MATTES
Yu. Goletsi, Yu. Shmidl, and F. Segnalek *In its* Nonferrous Met. 29 Jun. 1964 p 99–107 refs (See N65-10737 01-17)

Thermodynamic analysis of the conversion of copper matte and theoretical possibilities of the continuous conversion of copper matte are discussed. In particular, a description is given of the prerequisites for the use of continuous conversion of copper mattes in the production of converter copper in a single installation, and the technology for such a process is suggested. P.V.E.

N65-10745# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PROBLEM OF OBTAINING PURE MAGNESIUM IN ELECTROLYTIC REFINING
U. D. Deyter and A. I. Belyayev *In its* Nonferrous Met. 29 Jun. 1964 p 125–137 refs (See N65-10737 01-17)

The effect of electrolyte composition on the yield, in terms of current in the electrolytic refining of magnesium, was investigated, and an attempt was made to find the electrolyte composition that gives the highest cathode yield on a current basis. Conclusions reached included the following: (1) The highest current-based cathode yield in the electrolytic refining of magnesium is obtained for a cathode-current density of 1.70 A/cm^2, using an electrolyte based on melts of the system $MgCl_2$-KCl-NaCl. (2) Additions to the electrolyte of $CaCl_2$ and $BaCl_2$, in addition to increasing the specific gravity of the electrolyte, have a positive influence on the current-based yield, especially in melts rich in potassium chloride. The presence of $BaCl_2$ in electrolytes free of KCl can lead to a certain decrease in the current-based cathode yield. (3) The optimal working temperature of the process of electrolytic refining of magnesium is approximately 680° C. P.V.E.

N65-10750# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DETERMINATION OF THE ORIENTATION OF TUNGSTEN CRYSTALS BY ETCHING FIGURES
A. I. Pekarev *In its* Nonferrous Met. 29 Jun. 1964 p 166–171 refs (See N65-10737 01-17)

The metallographic method consists of the following. The polished section of the metal sample is subjected to a special etching (chemical, electrolytic, vacuum) to display etching figures (EF), whose forms depend on the method of etching the crystal lattice and on the orientation of the crystal with respect to the section surface. Determination of the orientation for the triangular etching figures, determination of the orientation for quadrangular etching figures, and forms of etching figures as a function of orientation on the stereographic triangle are discussed in detail. P.V.E.

N65-10753# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EFFECT OF MAGNESIUM AND CALCIUM ON THE CORROSIONAL RESISTANCE OF NICKEL IN A FLUORINE ATMOSPHERE AT 700–850°
A. V. Kurdyumov, V. N. Goloborodov, and M. A. Stepanov *In its* Nonferrous Met. 29 Jun. 1964 p 191–201 refs (See N65-10737 01-17)

The hardness, corrosional resistance in fluorine at 700° to 850° C, and the microstructure of nickel and its alloys with magnesium (to 6 wt.%) and with calcium (to 4 wt.%) in the cast state have been studied. The alloying of nickel with calcium decreases its corrosional stability. Alloying with magnesium not only does not diminish, but in several cases favors increase in nickel resistance. The reason for the increased resistance of nickel under these conditions can be found in the formation of a denser, stronger, and harder-to-remove film of magnesium fluoride. Alloys of nickel with magnesium can be successfully fused in fluorine-containing gaseous media at elevated temperatures. Author

N65-10776# Connecticut U., Storrs
METALLURGICAL FACTORS INFLUENCING THE MAGNETIC ANALYSIS OF SURFACE HARDENED AND TEMPERED STEEL Final Progress Report
Edward L. Bartholomew, Jr. and Ronald R. Biederman 1 Oct. 1963 21 p refs
(Contract DA-19-020-AMC-0233(W))
(AD-422662)

Continued investigation has shown that residual stress, retained austenite, and percarbide formation in martensite plates influence the magnetic analysis of H-8620 steel. The effect of carbide appearance has been evaluated at constant levels of austenite and stress. Surface residual stress varied inversely with surface retained austenite. The austenite distributions varied exponentially with depth (case to core). Residual stress distributions for various heat treatments were similar, showing marked differences only near the surface. Author

N65-10806# Rensselaer Polytechnic Inst., Troy, N.Y.
CORROSION STUDIES IN MOLTEN ALKALI CARBONATES. PART III: GOLD-PALLADIUM, NICKEL, AND STAINLESS STEEL-347
G. J. Janz and A. Conte Nov. 1963 7 p refs Submitted for Publication
(Contract Nonr-591-(10))
(TR-18; AD-422486)

An investigation was made of the ability of gold–palladium, nickel, and columbium-stabilized stainless steel to withstand a chemical attack in molten alkali carbonates at high temperatures of 600° to 700° C. The eutectic mixture of Li_2CO_3, Na_2CO_3, and K_2CO_3 was used in the attack. All specimens were boiled in water after the exposure, in order to remove any carbonates and soluble corrosion products, and the nature of the film on the surface of the metals was examined by X-ray diffraction methods. A series of weight-loss measurements were also undertaken. It was found that Au-Pd is highly resistant to this chemical attack, and that passivity can be conferred by the use of a galvanic couple of the noble metal with a less-resistant specimen. G.G.

N65-10835# Hanford Atomic Products Operation, Richland, Wash.
IRRADIATION BEHAVIOR OF HIGH PURITY URANIUM
R. D. Leggett, T. K. Bierlein, and B. Mastel Nov. 1963 51 p refs
(Contract AT(45-1)-1350)
(HW-79559) OTS: $3.00

Controlled-temperature NaK-filled capsules were used to establish the irradiation behavior of small, nonclad, tubular, high-purity dingot, uranium specimens over the temperature range 300° to 650° C and burnup range 0.03 to 0.4 at. %. Density measurements and optical and electron metallography were used to assess the irradiation effects. It was established that fission gases play only a minor role in the irradiation behavior of these uranium specimens. Below 600° C, the interaction and recovery of fission-event-induced defects lead to gross specimen distortion, and in the 400° to 600° C range, account for very large volume increases. Above 600° C, the volume increase is much smaller, and agglomeration of fission gas into pores becomes a contributing factor; below 350° C, no volume change occurs. Author

N65-10836# Hanford Atomic Products Operation, Richland, Wash.
SELECTED MECHANICAL PROPERTIES OF IRRADIATED METALS AND ALLOYS. IRRADIATION EFFECTS ON STRUCTURAL MATERIALS
Spencer H. Bush 1 Oct. 1964 112 p refs
(HW-81334, Pt. 2)

Data are tabulated for various structural materials, including austenitic stainless steels; ferritic and martensitic stainless steels; magnesium and its alloys; aluminum and its alloys; beryllium; zirconium and its alloys; Zircaloy-2, -3, and -4, and nickel-base alloys, Inconel, and Hastelloy. D.S.G.

N65-10856# Bureau of Mines, Berkeley, Calif. Berkeley Thermodynamics Lab.
HIGH-TEMPERATURE HEAT CONTENTS AND ENTROPIES OF AKERMANITE, CORDIERITE, GEHLENITE, AND MERWINITE
Louis B. Pankratz and Kenneth Keith Kelley 1964 11 p refs
(BM-RI-6555)

The heat contents of four silicate minerals—akermanite, cordierite, gehlenite, and merwinite—were measured from 298° to around 1700° K by the dropping method. The results were compiled into tabular and equation forms suitable for thermodynamic calculations. The heat contents of these compounds are nearly additive with respect to their constituent oxides. Author

N65-10838# ManLabs, Inc., Cambridge, Mass.
THE TENSILE-DUCTILITY TRANSITION IN MOLYBDENUM Technical Documentary Report, 30 Apr. 1963–30 Apr. 1964
B. S. Lement and K. Kreder Wright-Patterson AFB, Ohio, WADD, Jul. 1964 92 p refs
(Contract AF 33(657)-8424)
(WADD-TR-61-181, Pt. IV; AD-603698)

An investigation was carried out to determine the nature of the tensile-ductility transition in recrystallized molybdenum strip of three interstitial contents. For a fine grain size, the tensile-ductility transition temperature (T_d) and the brittleness transition temperature (T_b) were found to approximately coincide, whereas with increase in grain size T_d is raised and T_b is lowered. The occurrence of a minimum in the fracture stress (σ_F) at T_d appears to be associated with the temperature dependence of the necking stress (σ_n). Prestraining above T_d was found to result in as much as a 20% increase in σ_F as determined at temperature below T_d. In general, the mode of fracture initiation was intergranular at T_d or below, with cleavage above T_d. For a test temperature above as well as below T_d, crack initiation appears to be the controlling step in fracture. Author

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N65-10003# Princeton U., N.J. Frick Chemical Lab.
HIGH TEMPERATURE POLYMERS: H-FILM AND SP-POLYMER
H. D. Mair, M. C. Shen, and A. V. Tobolsky Aug. 1964 13 p refs
(Contract Nonr-1853(07))
(ONR-TR-RLT-83; AD-604010)

The viscoelastic properties of the polymers were studied; they show no glass transition temperature and no melting

point over the entire temperature range to 500° C. The viscoelastic properties reported here are different from those of any polymers studied to date. Since their molecular structure is reasonably well known, it is believed that other polymers of the "stiff chain" type will show similar viscoelastic properties. The lack of aliphatic hydrogen makes these polymers peculiarly resistant to oxidation. This feature can also be duplicated in similar families of polymers. These polymers indicate that very great thermal stability and relatively temperature-insensitive viscoelastic properties can be achieved by organic polymers. Author

N65-10374*# IIT Research Inst., Chicago, Ill. Armour Research Foundation
STABLE WHITE COATINGS Interim Report, Apr. 1–Oct. 1, 1962
Gene A. Zerlaut and Y. Harada 13 Nov. 1962 102 p refs
(Contracts NAS7-100; JPL-950111)
(NASA-CR-51002; ARF-3207-14) OTS Prices: HC $4.00/MF $1.00

Candidate coatings were exposed to an extraterrestrial ultraviolet environment for periods up to 3100 equivalent sun-hours. Emphasis was placed on developing usable zinc oxide–potassium silicate coatings and zinc oxide–pigmented methyl silicone polymers. The physical properties of these systems were studied in detail. These studies showed that zinc oxide–potassium silicates possess ultraviolet stability superior to that of all other pigment–vehicle systems examined. The potassium silicate coatings are better solar reflectors than the methyl silicone paints, possessing solar absorptance of 0.15 versus 0.22 for the silicones. An ion-pump space-simulation chamber was constructed, making possible longer, cleaner exposures at solar factors of 4 to 18 equivalent intensities. Author

N65-10394# Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
PHOTO-ELASTICITY OF POLYMERS (I)
Jiro Tsuji and Kozo Kawada 22 Sep. 1964 23 p refs Transl. into ENGLISH from Oyo Butsuri (Tokyo), v. 23, No. 9, 1964 p 387–394
(RSIC-277; AD-607083)

A general review is presented of the history of polymer photoelasticity, the measurement of photoelastic effects, relationships between photoelasticity and temperature, and elastomer photoelasticity. M.P.G.

N65-10414# Kaysam Corp. of America, Paterson, N.J.
NEOPRENE ELASTOMERS FOR BALLOON FABRICATION Second Quarterly Progress Report, 1 Jun.–31 Aug. 1964
Eric Nelson [1964] 48 p
(Contract DA-36-039-AMC-03737(E))
(Rept.-2; AD-450852)

The following topics are presented: "Evaluation of Neoprene Polymers"—physical properties determined of films obtained by dipping in dry neoprene solutions; "Evaluation of Other Raw Materials"—antiozonants and antioxidants, and plasticizers; "Evaluation of Processing Techniques"; "Investigation of Balloon Film Structure"—photomicrographs of uncompounded and compounded neoprene films; "Correlation of Balloon Flight Performance and Compound Properties"—balloons made from compound A5-101 reaching altitudes of more than 130 000 feet, and good results with balloons from a standard dual-purpose compound, but cured at lower than normal temperatures; "Correlation of Atmospheric Parameters and Compound Properties"—ozone flights analyzed according to performance, and relationship determined between bursting altitude and ozone concentration at various levels. G.G.

N65-10499# Naval Research Lab., Washington, D.C. Chemistry Div.
POLYURETHANE LININGS FOR STEEL FUEL-STORAGE TANKS
J. R. Griffith and G. E. Rohl 15 Oct. 1964 9 p refs
(NRL-6139; AD-607355)

In the bottom areas, where polyurethane linings are exposed to water, blistering has occurred. The blisters are tough, liquid-filled hemispheres, which generally develop within the layers of the coating. Upon the basis of numerous immersion experiments, it is suggested that there are sites within polyurethane coatings that are particularly subject to blister initiation. Evidence has been collected to indicate that these sites may be minute, carbon dioxide bubbles formed by side reactions of the coating components. Several means of reducing the numbers and sizes of blisters have been found, and work is in progress to prevent the blister formation completely. Author

N65-10513# Southern Research Inst., Birmingham, Ala.
THE DEVELOPMENT AND EVALUATION OF HEAT-RESISTANT, RAIN-EROSION-RESISTANT COATINGS Final Summary Report, 26 Jun. 1963–26 Jun. 1964
R. B. Perkins 31 Jul. 1964 49 p
(Contract N-156-43450)
(AD-604023)

A coating based on Viton A, a fluorocarbon polymer, was developed that provides good resistance to rain erosion (abrasion), as determined by the Jet Abrader Method, after exposure to high temperatures or to weathering. The abrasion resistance of Viton A coatings was decreased only slightly by exposure at 500° F for 15 hours or by exposure for 300 hours in an Atlas Twin-Arc Weather-Ometer. A number of silicon-nitrogen polymers were synthesized and evaluated, and, although some of these polymers had outstanding resistance to high temperatures, none of the coatings prepared with these polymers had sufficient abrasion resistance to be useful for the purpose of this project. Author

N65-10576# Wyandotte Chemicals Corp., Mich.
SYNTHESIS OF LOW TEMPERATURE OIL RESISTANT URETHANE ELASTOMERS Quarterly Progress Report, 1 Jul.–30 Sep. 1963
S. L. Axelrood and W. J. Lajiness 30 Sep. 1963 20 p
(Contract DA-20-018-ORD-24883)
(QPR-4; AD-423013)

Elastomers were prepared from very high molecular weight polyether triols, dichlorobenzidine (DCB), and toluene diisocyanate (TDI), and their properties were evaluated. Moisture absorption of these elastomers was considerably improved over that of previous elastomers prepared from similar high molecular weight triols. This was due to the lower ethylene oxide content of these triols. Low temperature torsional moduli of these elastomers were excellent, but this was accomplished at the expense of lower physical properties and higher oil absorption. High molecular weight polyols were also prepared by coupling commercially available polyethers with sebacyl chloride. Elastomers prepared from these polyols had poor mechanical properties and high torsional moduli at low temperatures. Author

N65-10779# Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center
ALUMINOSILICATE GLASSES Data Sheets
John T. Milek Jul. 1964 75 p refs
(Contract AF 33(615)-1235)
(DS-139; AD-444101)

A compilation of the electrical properties of various aluminosilicate glasses is presented. Arrangement of the data sheets is

by code or number with a master identification chart relating the known chemical composition of each glass. Detailed electrical properties include dielectric constant, dielectric strength, dissipation factor, loss factor, and volume resistivity.. Each property is compiled over the widest possible range of temperatures and frequencies from references obtained in a search of the world's literature. Author

N65-10824# Army Chemical Center, Edgewood, Md. Chemical Research and Development Labs.
FIFTEENTH MATERIALS REVIEW, JULY 1963–JANUARY 1964
Arthur Lyem Jun. 1964 86 p refs
(CRDL-SP-5-4; AD-605214)

This report on materials research in the polymer and plastic fields contains the following subjects: "High Polymers"—chemistry, technology, and physical and chemical characteristics; "Plastic Materials"—engineering methods, construction materials, end-product behavior, nuclear aspects, medical and biological considerations, and commercial and military applications; "Synthetic Fibers"—manufacturing techniques, textile wet-processing, properties, and industrial applications; "Miscellaneous Organic and Inorganic Compounds"; and "Metals and Alloys." G.G.

N65-10916*# Shell Development Co., Emeryville, Calif.
REINFORCED PLASTIC LAMINATES FOR LONG TIME HIGH TEMPERATURE USE **Monthly Letter Report**
Apr. 1963 4 p Partially sponsored by NASA
(Contract AF 33(657)-9063)
(AD-451221)

Results have been obtained on the aging of 14-ply laminates prepared from three epoxide-type resin systems for 500 hr at 500° and 550° F. The flexural strength dropped to 10 000 psi at test temperature after about 470 to 650 hr at 500° F and 200 to 340 hr at 550° F. Occasional samples of one system (EPON 1031/1 phr BF_3·MEA) were the most stable. Several new epoxides have been screened in the form of 4-ply laminates. The polyglycidyl ether of dihydroxydiphenyl ether gave laminates less thermally stable than earlier castings. Several phthalocyanine compounds have been prepared and screened as curing agents for epoxy resins. Author

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N65-10019# Martin Co., Baltimore, Md. RIAS Div.
FELLOWSHIPS FOR BASIC RESEARCH FOR NONLINEAR DIFFERENTIAL EQUATIONS **Final Report, 5 Nov. 1963–28 Aug. 1964**
L. Weiss, R. Datko, and K. Meyer [1964] 9 p refs
(Contract DA-36-034-AMC-0221(X))
(AD-448057)

This is a report on the development and application of the differential equation theory for the following: (1) the time domain theory of linear systems; (2) the transform domain theory of linear systems; (3) the optimal control theory; (4) the singular perturbation problems of difference-differential equations; and (5) the effects of delayed neutrons on the stability of nuclear reactors. G.G.

N65-10139# Joint Publications Research Service, Washington, D.C.
COMBINED METHOD OF ANALYSIS OF OPTIMAL ALLOCATION
O. G. Alekseyev and V. I. Yakushev *In its* Izv. VUZov: Inst. Bldg., No. 4, 1964 27 Oct. 1964 p 102–113 refs (See N65-10126 01-14) OTS: $6.00

A method is proposed for the computation of optimal allocation of equipment using the method of dynamic programing. To limit the region of search, additional conditions obtained from the approximate solution are introduced. An algorithm and a block diagram that executes this algorithm are presented. Author

N65-10221# RAND Corp., Santa Monica, Calif.
DYNAMIC PROGRAMMING AND THE JACOBI CONDITION OF THE CALCULUS OF VARIATIONS
Stuart E. Dreyfus Aug. 1963 17 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3714-PR; AD-413274)

In the dynamic programing approach to the calculus of variations, it is assumed that a discrete version of an optimization problem approaches the continuous statement as the increment in the independent variable approaches zero. This assumption is examined, and a condition that must be satisfied if the passage to the limit is to be valid is discovered. This condition is shown to be equivalent to the Jacobi necessary condition of the classical theory. The exploration of this connection between dynamic programing and the classical theory yields a new form of the Jacobi condition. In its new form, the Jacobi condition is seen to provide a rule for adjusting the optimal solution to take account of slightly perturbed initial conditions. Author

N65-10234# Stanford U., Calif.
OPTIMAL GROUP TESTING
Milton Sobel (Minnesota U.) 10 Jul. 1964 59 p refs
(Contract Nonr-225(53))
(TR-72; AD-607063)

This is a study of an optimal group-testing procedure incorporating the characteristic feature of the simultaneous testing of any number of units. The problem is to devise a sequential scheme that minimizes the expected number of tests required to clarify all of the given units as being good or bad. A theorem is developed using the fact that any binary code can be regarded as an algorithm in which probabilities are combined, and that the cost of the code can be obtained by adding all the original probabilities and sums formed in this algorithm, omitting the final sum (which is equal to one). G.G.

N65-10243# California U., Los Angeles
DISCRETIZATION METHODS FOR RETARDED ORDINARY DIFFERENTIAL EQUATIONS
Morley Alan Feldstein (Ph.D. Thesis) Aug. 1964 66 p refs
(Grants DA-ARO(D)-31-124-G77; DA-ARO(D)-31-124-G570)
(AD-601461)

The discrete variable approach is used in solving the initial value problem that is stated as follows: Let $\alpha(x)$ be a continuous real function satisfying $a \leq \alpha(x) \leq x \leq b$; let $y(a) = y_0$ a given real number; then the retarded ordinary differential equation $y'(x) = f(x, y(x), y(\alpha(x)))$ has a unique local solution $y(x)$ provided that f is continuous in its first argument and satisfies an Lip_1 condition in its other arguments. A first-order one-step algorithm is introduced, and it is shown that, under suitable hypotheses, it converges uniformly on finite intervals to the unique solution $y(x)$, and also that the discretization error is bounded and independent of α. A parameterized version

is shown to be similarly bounded and convergent. The conversion dependence upon the functions f and α is investigated, and the error is approximated for finite but small h by means of an asymptotic error expansion. Constructed is a function e(x), which is defined as the solution of a retarded ordinary differential equation. The bound of this asymptotic expansion is not independent of α, and therefore, for the simplified algorithm, the asymptotic expansion is not expressible in integer powers of h, but is expressible in fractional powers. M.P.G.

N65-10251# Radiation, Inc., Melbourne, Fla.
ON SOME DOUBLE ORTHOGONALITY PROPERTIES OF THE SPHEROIDAL AND MATHIEU FUNCTIONS Scientific Report No. 2
Donald R. Rhodes 15 Sep. 1964 30 p refs
(Contract AF 19(628)-4007)
(AFCRL-64-641; AD-607135)

The spheroidal and Mathieu functions are shown to form complete orthogonal sets over two separate intervals simultaneously. The normalization factors over each of these two intervals, (−1, 1) and (−∞, ∞), are derived. Author

N65-10258# Uppsala U. (Sweden)
QUANTUM CHEMISTRY GROUP FOR RESEARCH IN ATOMIC, MOLECULAR AND SOLID-STATE THEORY SEPARATION OF EIGENVALUES FOR TRIDIAGONAL MATRICES
J.O. Nordling 1 Jul. 1964 15 p refs *Its* Preprint No. 126
(Contract AF 61(052)-701)
(SR-21; ARL-64-212; AD-607402)

An extensive generalization of the separation theorem is obtained for tridiagonal matrices, and some simple applications are discussed. A complete scheme for eigenvalue calculation is given, and it is modified to the case of "almost tridiagonal" matrices. Author

N65-10320# Harvard U., Cambridge, Mass. Cruft Lab.
PARTIAL DIFFERENTIAL EQUATIONS FOR DENSITIES OF RANDOM PROCESSES Technical Report No. 445
Terrence Fine 4 May 1964 14 p refs
(Contract Nonr-1866(16))
(NR-372-012; AD-604005)

The Fokker–Planck–Kolmogorov (FPK) equation appears to be of wider applicability than is commonly realized. It is proved that the density functions for a wider class of vector random processes than just the Markov processes satisfy the FPK equation. Furthermore, an analogous derivation yields a different partial differential equation applicable to multivariate densities for scalar random processes. The central technique is the evaluation of time derivatives of the characteristic function for the random variables of interest by two different methods; the comparison of the two different expressions for the time derivatives then yields the desired partial differential equations. Author

N65-10340# Basel U. (Switzerland) Mathematics Inst.
[MATRIX ALGEBRA AND COMPUTER MATHEMATICS] Final Technical Report, 1 Jun. 1963–30 May 1964
A. Ostrowski [1964] 23 p
(Contract DA-91-591-EUC-2824)
(AD-603781) OTS: $1.00

Investigations involving the following are discussed: (1) the proof of Runge's Rule of Signs; (2) the determination of the criterion for the convergence and divergence of infinite series; (3) the extension and explanation of the results of Kronecker on the Simultaneous Diophentine Approximations; and (4) the proof that Laguerre's formulas derived for a polynomial of degree n are convergent for all polynomials (with only real roots) of degrees not exceeding n. P.V.E.

N65-10422# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
AN INEQUALITY FOR CONVEX FUNCTIONS INVOLVING MAJORIZATION Mathematical Note No. 356
Albert W. Marshall and Frank Proschan Jul. 1964 9 p refs
(DI-82-0360; AD-604251) OTS: $1.00

A simple inequality involving expectations of convex functions and the notion of majorization is derived. Although the result is easily obtained, it yields as special cases Karamata's inequality, Muirhead's theorem, and several new theorems. Author

N65-10508# Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
ASYMPTOTIC DIFFERENTIAL-DELAY EQUATIONS
Leon Kotin Sep. 1964 22 p refs
(TR-2498; AD-607259)

This report is devoted to the general first-order linear homogeneous differential-delay equation, with some generalizations to nonlinear and higher order equations. In particular, the oscillatory behavior and bounds of solutions of such equations are discussed. Author

N65-10519# Stanford U., Calif. Computer Science Div.
ON CLOSEST NORMAL MATRICES
Robert L. Causey 30 Jun. 1964 135 p refs
(Contract Nonr-225(37))
(CS10; AD-603163)

This study on closest normal matrices considers the following problem: To find those normal matrices (called v-minimal matrices) of the given order n by n matrix A of complex elements, which are closest to A in the sense of a metric defined in terms of a norm v. The related problem of determining the distance $d_v(A)$ between A and the subset N of all normal matrices of the order n is also presented. G.G.

N65-10525# Wisconsin U., Madison Mathematics Research Center
ON THE TWO POINT CONNECTION PROBLEM FOR SECOND ORDER LINEAR ORDINARY DIFFERENTIAL EQUATIONS WITH POLYNOMIAL COEFFICIENTS Technical Summary Report
Po-Fang Hsieh and Yasutaka Sibuya Sep. 1964 37 p refs
(Contract DA-11-022-ORD-2059)
(MRC-505; AD-607821)

This is a study of a linear differential equation

$$y'' + P(x)y = 0,$$

where $P(x) = x^m + a_1x^{m-1} + \ldots + a_{m-1}x + a_m$ and the a_j are constants. It is proved that there exist two linearly independent solutions that admit asymptotic representations as x tends to infinity and that are entire functions of $(x, a_1, \ldots, a_m)$. Then by expressing them as power series of $(a_1, \ldots, a_m)$ it is shown how to construct the coefficients of these power series in the large as functions of x. Author

N65-10564# Michigan U., Ann Arbor
VARIANTS OF THATCHER'S ALGORITHM FOR CONSTRUCTING PULSERS
S. Hedetniemi Aug. 1964 19 p refs
(Contract Nonr-1224(21))
(TR-03105-29-T; AD-604748)

This study pertains to algorithms for the construction of pulsers that are smaller in area and have shorter delays between input stimuli and output sequences than pulsers constructed by other methods. An iterative scheme is developed for the improvement of Thatcher's algorithm, and makes a more efficient use of the cells within the pulser; also, a non-iterative algorithm for the construction of an end pulser is presented. The calculations for an end pulser with adjacent confluent cells, neither of which may feed or receive stimulation from the other, are discussed. G.G.

N65-10578# Wisconsin U., Madison Mathematics Research Center
NUMERICAL COMPUTATION OF NONLINEAR FORCED OSCILLATIONS BY GALERKIN'S PROCEDURE
Minoru Urabe and Allen Reiter Sep. 1964 49 p refs
(Contract DA-11-022-ORD-2059)
(MRC-510; AD-607824)

In a previous paper it was proved that, for any periodic differential system

$$dx/dt = X(x,t),$$

an isolated periodic solution lying inside the region of definition of $X(x,t)$ can be always obtained by Galerkin's procedure if $X(x,t)$ and its derivative with respect to x are continuously differentiable with respect to x and t. In the present paper, the practical numerical method based on this result is described, and some numerical examples are presented. Author

N65-10610# Stanford U., Calif.
GENERALIZED CONVEXITY CONES
Zvi Ziegler 4 May 1964 127 p refs
(Contract Nonr-225(28))
(TR-39; AD-445000)

Concepts related to generalized convexity are introduced prior to seeking simpler conditions, in order that a function $f(x)$ belong to the dual cone of $C(\psi_1, \ldots \psi_n)$ by finding weaker sufficient conditions, as well as stronger necessary conditions. A representation theorem is then used for functions of the cone in terms of the extreme rays. Two derivations by which necessary and sufficient conditions for a measure to belong to the cone dual to the cone of positive, increasing, and convex functions are presented. Some interesting properties of the concept of generalized convexity are elaborated, and the preceding ideas are extended to the formulation of a multivariate version. M.P.G.

N65-10700# Travelers Research Center, Inc., Hartford, Conn.
REGRESSION ESTIMATION OF EVENT PROBABILITIES
R. G. Miller 18 Sep. 1963 *In its* Weather Data Processing Res. and Develop. Program [1963] 5 p refs (See N65-10699 01-20)

This study presents a modification of the discriminant analysis used in the prediction of the probability of critical airfield ceiling and visibility conditions. A series of multiple regressions for a set of zero to one dependent variables are performed, where each variable is associated with one of the predicted groups. The independent variables must be the same throughout each of the regressions. The regression functions for the estimated group probabilities were formed by equations. The results on independent forecasts were found to be equivalent to those of the Fix–Hodges nonparametric procedure. G.G.

N65-10754# Joint Publications Research Service, Washington, D.C.
TECHNICAL CYBERNETICS, NO. 4, 1964
10 Nov. 1964 279 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Tekhn. Kibernetika (Moscow), no. 4, Jul.–Aug. 1964 p 1–284
(JPRS-27297; TT-64-51553) OTS: $6.00

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18. PERIODIC CONDITIONS IN PULSE SYSTEMS WITH SATURATION AND A ZONE OF INSENSITIVITY Yu. M. Korshunov p 201–211 refs (See N65-10772 01-19)
19. ON DETERMINATION OF PERIODIC CONDITION IN DIGITAL AUTOMATIC SYSTEMS M. I. Londer p 212–226 refs (See N65-10773 01-19)
20. INVESTIGATION OF STABILITY OF MECHANICAL SYSTEMS WITH MANY DEGREES OF FREEDOM B. I. Rabinovich p 227–243 ref

21. ON DETERMINATION OF DYNAMIC CHARACTERISTICS OF AUTOMATIC CONTROL SYSTEMS V. L. Chernikov p 244–253 refs

22. ON SELECTION OF THE BASIC PART OF TRANSIENT PROCESSES IN AUTOMATIC CONTROL SYSTEMS V. A. Klimov p 254–268 refs

23. ON A CLASS OF LEARNING MACHINES V. A. Dolyatovskiy and Ye. M. Sotnikov p 269–274 refs

24. SIMULATION OF DRAG OF THE EARTH DURING VIBRATION PILE-DRIVING O. A. Podol'nyy, V. L. Ruslanov, V. A. Smirnov, and I. S. Ukolov p 275–278 ref

N65-10755# Joint Publications Research Service, Washington, D.C.

ON IDLE DUPLICATION

B. V. Gnedenko *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 1–13 refs (See N65-10754 01-19) OTS: $6.00

Some circuits have idle reserve circuits. The reserve circuit is put into operation quickly on breakdown of the basic circuit. The length of time of trouble-free operation of a duplicated system is studied. Author

N65-10756# Joint Publications Research Service, Washington, D.C.

ON THE PROBLEM OF RELIABILITY OF TECHNICAL SYSTEMS WITH REGULARLY RENEWABLE RESERVE

A. L. Paykin, A. F. Rubtsov, and V. S. Penin *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 14–21 refs (See N65-10754 01-19) OTS: $6.00

A reserve system over equal intervals τ, which comes to the stage of technical service where the faulty blocks in a negligibly small time are replaced by reserve blocks, is investigated. A procedure is given for the determination of reliability of this system at the end of an arbitrary interval of time (0,t) under the condition of a finite number of n reserve blocks. Author

N65-10757# Joint Publications Research Service, Washington, D.C.

OPTIMAL PROCEDURES FOR LOCALIZATION OF BREAKDOWN IN A MODULATED RADIOELECTRONIC SYSTEM

Yu. V. Lyubatov *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 22–32 refs (See N65-10754 01-19) OTS: $6.00

The problem of searching for a specific breakdown is investigated in a radioelectronic system made up of independent "modules." A defined procedure for checking the system minimizes the average time required for localization of the breakdown module. A case is investigated where breakdown of the system is not certain. Author

N65-10758# Joint Publications Research Service, Washington, D.C.

ON OPTIMAL RESERVING OF AN APPARATUS

A. G. Korman *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 33–50 refs (See N65-10754 01-19) OTS: $6.00

Problems of optimal reserving, with limitations of weight, and of optimal outfitting of a measuring-instruments plant are investigated, taking into consideration cost limitations. Problems are solved for the optimal probability of trouble-free operation with a given limitation of weight of reserve elements (cost of the plant) and for the determination of the optimal (least) weight or cost for a given probability of trouble-free operation. Author

N65-10759# Joint Publications Research Service, Washington, D.C.

ON CALCULATION OF RELIABILITY OF SYSTEMS TAKING INTO ACCOUNT THE PROBABLE CONDITION OF USE OF THEIR ELEMENTS

S. Yu. Ruderman *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 51–53 refs (See N65-10754 01-19) OTS: $6.00

An analysis is carried out of the reliability of a system of K individual elements, where each element is used by the system only from time to time. The special case where the elements are usually operated for a short time and can go out of order only by remaining on is considered. If the element usually is turned on for a short time, then the basic influence on its reliability is often not the total time of operation, but the number of switchings into the operating state. For a system consisting of K statistically independent elements, each of which is characterized by its own parameters λ_i, p_i, the reliability of the system is subject to an exponential law, and the average time of its trouble-free operation will be equal to

$$t = 1/\sum_{i=1}^{n}\lambda_i p_i.$$

P.V.E.

N65-10760# Joint Publications Research Service, Washington, D.C.

COMPARATIVE EFFECTIVENESS OF OPTIMAL LINEAR AND NON-LINEAR METHODS OF CODING OF CONTINUOUS COMMUNICATIONS

B. S. Tsybakov *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 54–58 refs (See N65-10754 01-19) OTS: $6.00

Two methods of transmission for a fixed continuous communication and a channel with additive noise are investigated. An equation is constructed for finding the ϵ^2 least error relative to the nonlinear procedure. For an exponential function of message correlation and δ correlated noise a numerical comparison is made of the ϵ^2 and the σ^2 least error attained for the linear procedure. For all investigated cases ϵ^2 and σ^2 closely approximate each other. Author

N65-10761# Joint Publications Research Service, Washington, D.C.

MATHEMATICAL PROCEDURES FOR INCREASING RELIABILITY OF REAL COMMUNICATION SYSTEMS

P. P. Varshamov *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 69–78 refs (See N65-10754 01-19) OTS: $6.00

A discrete system of communication, with arbitrary statistical structure of the noise source, is investigated. Author

N65-10762# Joint Publications Research Service, Washington, D.C.

LEAST SQUARE ERROR ON QUANTIFICATION OF CONTINUOUS MESSAGES WITH NOISE

A. I. Velichkin *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 79–91 refs (See N65-10754 01-19) OTS: $6.00

Investigated is quantification of continuous communications that are distorted by noise with a minimum least-square error. The optimal values of the levels, quantification thresholds, and minimum values of least-square error corresponding to them are determined. Quantification of communications that characterized the normal probability density is investigated in more detail. Author

N65-10763# Joint Publications Research Service, Washington, D.C.

SYNTHESIS OF AN OPTIMAL TWO-CHANNEL DISCRETE SYSTEM WITH MULTIPLE PERIODS OF DATA SAMPLING

R. A. Poluektov *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 92–106 refs (See N65-10754 01-19) OTS: $6.00

The problem of synthesis of an optimal two-channel discrete system is investigated in the case where the period of discrete measurement of the signal in one of the channels is a whole number of times greater than the period of discreteness of the other channel. The optimal system (system of discrete filters) may be realized, both in delay links and in a digital computer. Equations are derived for determination of the transfer functions of the discrete filters, and a procedure is proposed for their solution. Author

N65-10764# Joint Publications Research Service, Washington, D.C.

ON CONSTRUCTION OF BOOLEAN FUNCTIONS OF GREAT COMPLEXITY USING THE MONTECARLO METHOD

I. N. Kovalenko *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 107–112 ref (See N65-10754 01-19) OTS: $6.00

An algorithm is presented for construction of functions of the algebra of logic of many variables in which random elements participate. With quite high probability, the function constructed will have high complexity; the complexity of the algorithm that realizes the function will have the same order as the complexity of the constructed function guaranteed with quite high probability. Author

N65-10765# Joint Publications Research Service, Washington, D.C.

ON THE SOLUTION OF PROBLEMS OF NON-LINEAR MATHEMATICAL PROGRAMMING WITH ONE AND MANY EXTREMA ON ANALOG COMPUTERS

M. V. Gal'perin, G. I. Korotkevich, I. N. Minsker, and V. I. Rybasov *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 113–127 refs (See N65-10754 01-19) OTS: $6.00

The possibility of using the gradient procedure of Pyne for solution of problems of convex programing in analog machines is investigated. By a piecewise linear approximation, the multiextremal problem is reduced to a set of monoextremal problems, each of which is analyzed by a rapid action analog circuit. Author

N65-10766# Joint Publications Research Service, Washington, D.C.

SOLUTION OF THE PROBLEM OF MINIMIZATION OF DEVELOPMENT COST IN ANALOG MODELS

M. V. Rybashov and Ye. Ye. Dudnikov *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 128–145 refs (See N65-10754 01-19) OTS: $6.00

Possible realizations of the PERT cost procedures are realized in an analog electronic model. A graph is developed for the cost dependencies of the optimal plan for its duration; for each point of this graph, parameters are defined for the corresponding network of the optimal plan. For decreasing the volume of the solved problem it is proposed that one problem be divided into two with a fewer number of variables and that several parts of the planned network be replaced by new individual operations. The discussion is illustrated by examples. Author

N65-10767# Joint Publications Research Service, Washington, D.C.

ON PROPERTIES OF OPTIMAL LINEAR PULSE SYSTEMS

P. V. Nadezhdin *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 146–159 refs (See N65-10754 01-19) OTS: $6.00

The necessary and sufficient condition is obtained for the optimality of a pulse system in the sense of minimum, total, general quadratic error for any initial condition. For a definite statement of this problem the optimal system obtained is a system that is optimal with respect to rapid action. Author

N65-10768# Joint Publications Research Service, Washington, D.C.

ON A PROBLEM OF OPTIMAL CONTROL

L. Ye. Kanarev and I. P. Reznikov *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 160–167 refs (See N65-10754 01-19) OTS: $6.00

The problem of control of an object is investigated for an object having oscillatory characteristic motion. The method of construction of the control of such objects proposed in the article is based on use of part of the control effect for elimination of oscillations; the remaining part is used for achievement of limited rapid action of the system. Author

N65-10769# Joint Publications Research Service, Washington, D.C.

EVALUATION OF RAPID ACTION OF SELF-ADJUSTING SYSTEMS WHICH OPERATE CLOSE TO THE LIMIT OF STABILITY

Yu. M. Kozlov *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 168–177 refs (See N65-10754 01-19) OTS: $6.00

The possibility is investigated of application of procedures developed for evaluation of the time of the intermediate process in self-adjusting systems with an oscillating stability limit. A procedure is proposed based on separation of a constant component of oscillations in a self-adjusting chain that contains even, symmetric nonlinearity. Author

N65-10770# Joint Publications Research Service, Washington, D.C.

OSCILLATIONS IN RELAY SYSTEMS OF EXTREMAL CONTROL WITH SYNCHRONOUS DETECTION

I. I. Beloglazov and N. P. Shchetinin *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 178–191 ref (See N65-10754 01-19) OTS: $6.00

The occurrence of simple subharmonic oscillations in relay circuits of extremal control with synchronous detection is proved. Conditions are derived for the existence of necessary and subharmonic conditions depending on the amplitude and frequency of the search signal. The parameters of the subharmonic oscillations are determined. Author

N65-10771# Joint Publications Research Service, Washington, D.C.

CALCULATION OF DELAY IN SELF-ADJUSTING SYSTEMS OF CONTROL

R. M. Yusupov *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 192–200 refs (See N65-10754 01-19) OTS: $6.00

For certain assumptions the self-adjusting system of control may be brought to an equivalent usual system, with delay caused by the specific character of operation of the self-adjusting circuit. The system is investigated by well-known methods, in particular by evaluation of the influence of delay on the dynamics of the control process. The simplest examples are considered. Author

N65-10772# Joint Publications Research Service, Washington, D.C.

PERIODIC CONDITIONS IN PULSE SYSTEMS WITH SATURATION AND A ZONE OF INSENSITIVITY

Yu. M. Korshunov *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 201–211 refs (See N65-10754 01-19) OTS: $6.00

The peculiarities of application of the procedure of harmonic balance are investigated as applied to nonlinear pulse

systems with nonlinearities of the saturation type having a zone of insensitivity. In these pulse systems conditions are possible for which the signal at the output of the nonlinear pulse element is a periodic lattice function with a relative period, N, which is a whole even number whose envelope has the period N/ν where N and ν are relatively prime numbers. These types of periodic conditions are defined, and graphs are presented for the equivalent complex coefficient of amplification for the forms of the nonlinearities investigated. Author

N65-10773# Joint Publications Research Service, Washington, D.C.
ON DETERMINATION OF PERIODIC CONDITION IN DIGITAL AUTOMATIC SYSTEMS
M. I. Londer *In its* Tech. Cybernetics, No. 4, 1964 10 Nov. 1964 p 212–226 refs (See N65-10754 01-19) OTS: $6.00

Determination of periodic conditions in digital automatic systems presents, for a large number of intervals of quantification with respect to level, a very time-consuming problem. An approximate procedure is proposed for construction of regions of existence of periodic conditions that make it possible to determine the maximum possible amplitude of these conditions and also to determine the requirements for the pulse frequency characteristics of the derived continuous part, for exclusion of the possible occurrence of periodic conditions with an amplitude exceeding the given level. Author

N65-10820*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
MATHEMATICAL MODELS OF MISSILE LAUNCHING
Alfred C. Dahlgren 21 Aug. 1964 10 p refs
(Contract NAS7-100)
(NASA-CR-59494; JPL-TR-32-655, Pt. II) OTS Prices: HC $1.00/MF $0.50

By means of a mathematical model of the situation, including assumptions about the nature of the delays encountered, an estimate is presented of the expected number of days required to launch three missiles, each from its own pad, allowing simultaneous (i.e., same-day) countdowns but no simultaneous launches. Author

N65-10823# Illinois U., Urbana
NUMERICAL SOLUTION TO THE FLOW OF A GAS-SOLID SUSPENSION THROUGH A NOZZLE
John A. Hultberg Aug. 1964 95 p refs
(Contract Nonr-3623(00); Proj. Squid)
(ILL-17-R; AD-604107)

A method of numerical solution of the basic gas-dynamic equations involving suspended solids is presented for the case of an arbitrary area distribution. The velocity of sound in the two-phase mixture was computed. The importance of the throat condition is clarified, and the inadequacy of solutions without the throat condition is discussed. The numerical solution and the exact solution are presented for comparison. The complete program using the Runge–Kutta–Gill method is given in detail. Author

N65-10834# RAND Corp., Santa Monica, Calif.
INTEGRAL EQUATIONS WITH DIFFERENCE KERNELS OF FINITE INTERVALS. II: RESOLVENT KERNELS
A. Leonard and T. W. Mullikin Aug. 1964 29 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-4235-PR; AD-604460)

A technique is presented for the solution of certain integral equations, on a finite interval of the real line, that arise in the theories of neutron transport, radiative transfer, and linearized gas dynamics. The kernels in the equations studied are functions of the difference of the arguments and involve an exponential factor. By the methods of singular integral equations, the result for the resolvent kernel is obtained in the form of simple quadratures and rapidly convergent Fredholm equations. Author

N65-10843# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering
A CALORIMETRIC DEVICE FOR THE MEASUREMENT OF TOTAL HEMISPHERICAL EMITTANCE
Bobby R. Putnam (M.S. Thesis) Jun. 1964 106 p refs
(GAM/ME/64-15; AD-604834)

A steady-state calorimetric device, designed for the measurement of total hemispherical emittance of thin, flat disc specimens that are heated by thermal radiation from a hot wall, is evaluated over the emittance range of approximately 0.06 to 0.98. Equations are developed for the calculation of specimen emittance for which only temperatures need to be measured. Also, equations for determining the total heat loss (radiation plus conduction) through the disc thermocouple wires are developed. Thirteen specimens are evaluated at temperatures ranging between 0° and 180° F to determine the accuracy of the apparatus. Experimental results, compared to theoretical and reported emittance data, prove the apparatus to be reliable for extremely accurate emittance measurements over the entire emittance range of 0.06 to 0.98. Author

N65-10893# Stanford Research Inst., Menlo Park, Calif.
APPLICATION OF QUEUING THEORY TO INFORMATION SYSTEMS DESIGN Final Report
David Nee Bedford, Mass., AFSC, Jun. 1964 114 p refs
(Contract AF 19(628)-2901)
(ESD-TDR-64-428; AD-605806)

This research project was undertaken to investigate the application of queuing theory, in particular, the priority queuing theory, to structuring of information systems. A scheme of classifying queuing models and queuing literature was developed and was used to classify most of the known priority-queuing literature. The waiting-time distribution for a multiserver, head-of-the-line, priority-queuing model was developed. Priority-queuing formulas were catalogued and listed in accordance with the classification scheme. A simple single-stage priority-queuing model was constructed to demonstrate the feasibility of using such a model to augment the analytical modeling techniques in investigating more complex priority-queuing systems. Finally, procedures for the application of the queuing model to structuring of information systems were outlined. Author

N65-10906# Brandeis U., Waltham, Mass.
LOWER BOUNDS FOR THE HELMHOLTZ FUNCTION
Sidney Golden 15 Sep. 1964 10 p refs
(Contract Nonr-1677(01))
(TR-10; AD-606146)

A mathematical theorem is established for traces of products of bounded Hermitian and definite operators, $\underline{a}$ and $\underline{b}$:

$$\mathrm{Tr}(\underline{ab})^{2^{p+1}} \leq \mathrm{Tr}(\underline{a}^2\underline{b}^2)^{2^p}$$

for p a nonnegative integer. This theorem is applied to the equilibrium partition function by exploiting an infinite product representation of the exponential function of the sum of two operators. As a result, a set of inequalities is established that

yields a set of upper bounds for the partition function. This result is invariant to the particle statistics of the system. A general argument yields the result that the classical Helmholtz free-energy function serves as a lower bound to the corresponding quantum result. Author

N65-10942# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
WORKS ON THEORY OF FUNCTIONS OF COMPLEX VARIABLE
N. N. Luzin 4 May 1964 10 p Transl. into ENGLISH from Usp. Mat. Nauk (Moscow), v. 7, no. 2, 1952 p 3–6
(FTD-MT-63-299; AD-602575)

The author outlines and discusses the various papers he has written on the subject of the formulation of the problems of complex variables. P.V.E.

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N65-10046# Library of Congress, Washington, D.C. Aerospace Technology Div.
SOVIET METEOROLOGY AND CLIMATOLOGY. COMPILATION OF ABSTRACTS, 1962–1963 Report No. 2
5 Oct. 1964 101 p refs
(ATD-P-64-55)

The abstracts are compiled by author within four subject groups: (1) climatology of high levels; (2) general circulation of the atmosphere; (3) weather forecasting; and (4) regional studies and local phenomena. The abstracts are taken mostly from *Referativnyy Zhurnal. Geofizika*, and cover Soviet open literature published in 1962 and 1963. M.P.G.

N65-10301* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A QUASI-GLOBAL PRESENTATION OF TIROS III RADIATION DATA
Lewis J. Allison, Thomas I. Gray, Jr. (Weather Bur.), and Guenter Warnecke Washington, NASA, 1964 16 p refs
(NASA-SP-53) GPO Price: $2.00

A worldwide radiation map in the 8- to 12-micro atmospheric "window," as derived from TIROS III, Channel 2 measurements for July 16, 1961, is presented. The map, covering the globe between 55° N and 55° S, is superimposed on various conventional synoptic analyses to study the utility of satellite radiation data for meteorological-analysis purposes. The synoptic features shown include an intensive frontal system over the United States, including a squall line, four tropical storms in the Atlantic and Pacific Oceans, and a well-developed Asiatic monsoon. An extra-large format is employed. R.L.K.

N65-10321# Chicago U., Ill.
ON FORMATION AND INTENSIFICATION OF TROPICAL CYCLONES THROUGH LATENT HEAT RELEASE BY CUMULUS CONVECTION. PART I: INCLUSION OF RELEASE OF LATENT HEAT BY CONVECTION AND GENERAL THEORY
H. L. Kuo Aug. 1963 90 p refs
(CWB-WBG-13)
(SR-1; AD-423193)

Two dynamic models for the development and formation of tropical cyclones are investigated. A functional relationship is developed between the direct transport of heat and moisture to high levels by deep cumulus convections and that of the overall activity of such convective motions, which is controlled by the moisture supplied by large-scale motion. The accession of latent heat by convective motion is expressed in terms of the mean motion. Formulas for turbulent diffusions and the fluxes of various quantities through the lower boundary are derived. The first model assumes a permanent pressure gradient–tangential wind balance; the meridional circulation and its development with time are obtained; and boundary-layer effects are included. The second model includes the same physical conditions without the stringent gradient–wind requirement. Factors giving rise to instabilities of the axially symmetric perturbations are also analyzed. M.P.G.

N65-10331# Naval Postgraduate School, Monterey, Calif.
ON THE THERMAL STRUCTURE OF WAVES IN A SIMPLE BAROCLINIC MODEL INCLUDING FRICTION
Donald E. Caverly (M.S. Thesis) 1964 18 p refs
(AD-603433)

Beginning with linearized forms of the vorticity equation and the first law of thermodynamics applied to a simple baroclinic model including friction, an analytic solution is obtained that describes the time variation of the relative phase angle between the temperature and pressure waves in the atmosphere. It is found that for unstable waves the atmosphere tends toward a state where the temperature wave lags behind the pressure wave. The time variation of the amplitude and relative phase depends on the initial value of the phase difference, but the ultimate angle by which the temperature field lags the pressure field depends only on the drag coefficient, certain atmospheric parameters, and the wavelength of the waves. Author

N65-10380# Johann Wolfgang Goethe U., Frankfurt am Main (W. Germany) Inst. für Meteorologie und Geophysik
INVESTIGATIONS ON TROPOSPHERIC WASH-OUT Final Technical Report
Hans-Walter Georgii and Erich Weber Aug. 1964 82 p refs
(Contract AF 61(052)-249)
(AFCRL-64-816; AD-607089)

This report summarizes the results of chemical analyses of individual cases of precipitation sampled at different locations. The locations showed a great variety with respect to altitude, climate, and level of industrial and anthropogeneous pollution. Detailed analyses and continuous records of the trace-substance concentration during individual rainfalls are discussed. The variations of the concentration during the course of the rain and their relations to quantity, intensity, and types of rain, as well as to meteorological parameters, are discussed. Preliminary studies on the incorporation of trace-substances into cloud drops and raindrops are presented, indicating the relative importance of rainout compared to washout. Author

N65-10460# Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Environmental Sciences Directorate
FEASIBILITY EXPERIMENT FOR MEASURING ATMOSPHERIC DENSITY THROUGH THE ALTITUDE RANGE OF 60 TO 100 KILOMETERS OVER WHITE SANDS MISSILE RANGE Internal Report
Otto W. Thiele Oct. 1964 24 p refs
(AD-450230)

The experiment involved four soundings utilizing the accelerometer 7-inch falling sphere. All were successful, and data were obtained at altitudes in excess of 100 km in every case. The density data, with the derived temperature and pressure data, are presented. It has been demonstrated that high-altitude atmospheric density measurements can be made in the vicinity of 100 km reliably, and with an estimated maximum error of ±5 percent. Author

N65-10529# Joint Publications Research Service, Washington, D.C.

TRANSLATIONS FROM METEOROLOGIYA I GIOROLOGIYA (METEOROLOGY AND HYDROLOGY), NO. 9, 1964

3 Nov. 1964 57 p refs Transl. into ENGLISH of seven articles from Meteorol. i Gidrolog. (Moscow), no. 9, Sep. 1964 (JPRS-27205; TT-64-51450) OTS: $3.00

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N65-10530# Joint Publications Research Service, Washington, D.C.

BASIC PRINCIPLES OF AUTOMATION OF ANALYSIS OF AIRCRAFT METEOROLOGICAL DATA

N. Z. Pinus, G. N. Shur, N. K. Vinnichenko, and V. I. Chernysh 3 Nov. 1964 *In its* Transl. from Meteorol. i Gidrolog. (Meteorol. and Hydrol.), No. 9, 1964 p 1–10 refs (See N65-10529 01-20) OTS: $3.00

This study describes a data-gathering system to be used in the analysis of slowly changing aircraft-measured meteorological parameters. The entire apparatus is divided into "airborne" and "groundbase." A general functional block diagram is presented for a collection system of measurements, digital coding, magnetic recording, and the input into a digital computer. Results of the analysis are printed out and then fed to the external storage part of the computer, from which they can be extracted for machine analysis. G.G.

N65-10531# Joint Publications Research Service, Washington, D.C.

A NEW METHOD FOR CONSTRUCTING VERTICAL CROSS SECTIONS OF FRONTS

L. N. Gutman and S. B. Morgachev 3 Nov. 1964 *In its* Transl. from Meteorol. i Gidrolog. (Meteorol. and Hydrol.), No. 9, 1964 p 11–18 refs (See N65-10529 01-20) OTS: $3.00

A new method for the construction of vertical atmospheric profiles is presented, with emphasis on the dynamic factors of weather fronts and air masses. The normal front line of a vertical cross section of the flow field in a moving system of coordinates that move together with the front is considered. It is observed that the consideration of cross sections can increase the accuracy of the analysis of the vertical structure of the atmosphere. G.G.

N65-10532# Joint Publications Research Service, Washington, D.C.

ACCURACY AND RELIABILITY OF HYDROMETEOROLOGICAL OBSERVATIONS

A. I. Subbotin 3 Nov. 1964 *In its* Transl. from Meteorol. i Gidrolog. (Meteorol. and Hydrol.), No. 9, 1964 p 19–29 (See N65-10529 01-20) OTS: $3.00

The quality of hydrometeorological data gathering was found to be dependent not only on the accuracy of the instrumentational observations but also on the proper choice of the place of observation. In consideration of the data on precipitation, snow accumulation, and the depth of freezing of the soil over a period of years, it was found that the winter precipitation was not measured with sufficient accuracy, due to variations in locations of the precipitation gages. Evaporation measures during summer were also found to be inaccurate, due to the disruption of the wind regime, as well as other obstacles. The need for better standardized measuring sites is pointed out. G.G.

N65-10535# Joint Publications Research Service, Washington, D.C.

SOVIET INVESTIGATIONS OF ATMOSPHERIC POLLUTION

9 Nov. 1964 74 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), Issue 138, 1963 p 3–55 (JPRS-27279; TT-64-51535) OTS: $3.00

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N65-10536 Joint Publications Research Service, Washington, D.C.

NUMERICAL SOLUTION OF THE EQUATION OF TURBULENT DIFFUSION AND COMPUTATION OF ATMOSPHERIC CONTAMINATION NEAR INDUSTRIAL PLANTS

M. Ye. Berlyand, Ye. L. Genikhovich, V. P. Lozhkina, and R. I. Onikul *In its* Soviet Invest. of Atmospheric Pollution 9 Nov. 1964 p 1–20 refs (See N65-10535 01-20) OTS: $3.00

A numerical solution of the problem concerning turbulent diffusion of a weightless admixture in the boundary layer of the atmosphere from a point source is given allowing an investigation of the conditions affecting the distribution of gases and finely divided dust ejected from the smokestacks of industrial enterprises. A number of control methods of the

solution that is obtained are claimed. Examples are cited showing the calculation procedure with the aid of the Ural-1 electronic computer. An analysis of the results is given. Author

N65-10537 Joint Publications Research Service, Washington, D.C.
METEOROLOGICAL OBSERVATIONS MADE DURING AN INVESTIGATION OF INDUSTRIAL CONTAMINATION OF THE SURFACE LAYER OF AIR
B. B. Goroshko, V. P. Gracheva, G. P. Rastorguyeva, B. V. Rikhter, and G. A. Fedorova *In its* Soviet Invest. of Atmospheric Pollution, 9 Nov. 1964 p 21–36 refs (See N65-10535 01-20) OTS: $3.00

A program of meteorological observations is discussed for the purpose of studying the conditions involved in the dissemination of the discharges of industrial enterprises, along with the results of field work in the vicinity of the Shchekinskaya State Regional Electric Power Station. The program of observations involved gradient measurements, including measurements of the temperature and humidity of the air and wind velocities at elevations of from 0.2 to 17 m, the measurements of soil temperature at depths of up to 20 cm, as well as actinometric observations. The average data on the meteorological elements are cited, along with the results yielded by the computation of the coefficient of the turbulent exchange utilizing various methods. Author

N65-10538# Joint Publications Research Service, Washington, D.C.
ON THE THEORY OF TURBULENT DIFFUSION
M. Ye. Berlyand *In its* Soviet Invest. of Atmospheric Pollution, 9 Nov. 1964 p 37–45 refs (See N65-10535 01-20) OTS: $3.00

A solution of the problem pertaining to the turbulent diffusion of admixtures in the boundary layer of the atmosphere from point and linear sources has been obtained. It is taken that wind velocity u increases with altitude z in accordance with the exponential law $\mu = \mu_1 (z/z_1)^n$; the vertical component of the exchange coefficient is $k_2 = k_1 (z/z_1)^m$. A model according to which $k_y = k_0\mu_1 (z/z_1)^n$ is proposed for the horizontal component of the exchange coefficient k_y. Author

N65-10539 Joint Publications Research Service, Washington, D.C.
SOME RESULTS OF MICROCLIMATIC SURVEYS UNDER CONDITIONS OF RUGGED RELIEF
L. G. Semenova and I. I. Solomatina *In its* Soviet Invest. of Atmospheric Pollution, 9 Nov. 1964 p 46–50 refs (See N65-10535 01-20) OTS: $3.00

Microclimatic surveys of the terrain, conducted for the purpose of studying the dissemination of admixtures under conditions of rugged relief, are examined. Preliminary conclusions concerning the influence of various types of relief on the wind, temperature, and humidity in the surface layer of air are given on the basis of an analysis of the material yielded by the microsurveys. Author

N65-10540 Joint Publications Research Service, Washington, D.C.
POSSIBILITIES OF AN ASPIRATION METHOD OF MEASURING ATMOSPHERIC RADIOACTIVITY
N. N. Aleksandrov *In its* Soviet Invest. of Atmospheric Pollution, 9 Nov. 1964 p 51–68 refs (See N65-10535 01-20) OTS: $3.00

This article describes the filter-ventilation installation that is in use, the methods of measuring and computing the concentration of activity in the air, as well as certain results of the measurements. The results of the measurements are analyzed, and recommendations are given concerning the selection of the parameters of ventilating installations, the filter sizes, etc., for the achievement of the necessary accuracy of measurements. Author

N65-10699# Travelers Research Center, Inc., Hartford, Conn.
WEATHER DATA PROCESSING RESEARCH AND DEVELOPMENT PROGRAM Monthly Progress Report, Sep. 1963
Carl F. Jenkins Sep. 1963 22 p refs
(Contract CWB-10704)
(AD-420261)

CONTENTS:
1. WEATHER DATA PROCESSING RESEARCH AND DEVELOPMENT PROGRAM Carl. F. Jenkins 22 p refs
2. REGRESSION ESTIMATION OF EVENT PROBABILITIES R. G. Miller 5 p refs (See N65-10700 01-19)

N65-10778# Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
DATA REPORT OF THE METEOROLOGICAL ROCKET NETWORK FIRINGS. VOLUME VIII: SUMMER 1961 FIRINGS
Aug. 1964 276 p
(IRIG-109-62; AD-451254)

This is a meteorological data presentation for the summer of 1961 from various earthbound weather stations utilizing several meteorological rocket systems. The chaff dispersion and fall rates of Loki I, Loki II, Arkas, and the Arkas–Robin configuration are presented. The wind and altitude data were obtained by radar plotting grids through graphical conversion, and the wind profiles were derived by the computation of the connected time-interval data. The temperature values were observed by a radiosonde transmitter unit and recorded in raw form. G.G.

N65-10825# Air Weather Service, Thule, Greenland
FORECASTING SEVERE WINDS
Thomas A. Studer May 1964 45 p
(AD-447141)

In forecasting the behavior of storms that could affect Thule, factors unique to this area that should be considered are the blocking action of the Greenland Ice Cap, the heat source of the open water in Baffin Bay, and, in the immediate area, the shallow valley in which Thule lies, running from North Star Bay on the west and eastward up to the ice cap. Storms that have produced severe winds at Thule are described and classified into types, and forecast procedures for the different types of storms are presented. Surface charts of the different types of storms are given as examples. D.S.G.

N65-10854# Weather Bureau, Washington, D.C.
MANUAL FOR UPPER WIND CODE (WBAN)
Washington, GPO, 1 Jan. 1964 50 p Prepared jointly with Air Weather Service and Navy Weather Service GPO: $0.75

The manual provides specific coding instructions and reporting procedures for U.S. stations and information on the variations and additions to the upper wind code used by other services throughout the world. It includes information of a general nature, such as general procedures, definitions of terms, etc.; the coding of upper wind reports by stations on U.S. territory in North and Central America (WMO Region IV) and in the North Pacific area (WMO Region V); the complete upper wind code form as adopted by the WMO, plus the operating notes and code tables required for its use; and information on the various WMO Regions with respect to the adopted regional procedures and national variations, if any, that are being used. P.V.E.

N65-10879# Joint Publications Research Service, Washington, D.C.
PROBLEMS IN WEATHER FORECASTING
19 Nov. 1964 58 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 151, 1964
(JPRS-27448; TT-64-51697) OTS: $3.00

CONTENTS:

1. MULTILEVEL MODEL FOR PREDICTION OF THE GEOPOTENTIAL FIELD ON THE BASIS OF A SMALL NUMBER OF PARAMETERS L. V. Rukhovets p 1–20 refs

2. ON THE PROBLEM OF THE NUMERICAL FORECASTING OF CLOUDINESS AND PRECIPITATION, TAKING INTO ACCOUNT THE TRANSFORMATION OF AN AIR MASS V. P. Meleshko p 21–33 refs

3. ERRORS IN 500-mb AND 850-mb NUMERICAL FORECASTS IN RELATION TO CIRCULATION CONDITIONS G. D. Kudashkin p 34–57 refs

N65-10950# Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Inter-Range Instrumentation Group
METEOROLOGICAL ROCKET NETWORK FIRINGS. VOLUME XVII: JANUARY 1963 FIRINGS Data Report
Jul. 1964 88 p
(IRIG-109-62, Vol. XVII; AD-451204)

Wind and temperature measurements collected from all available Meteorological Rocket Network (MRN) firings during the month of January, 1963, plus radiosonde observations within 6 hours of the time of firing are presented. A total of seven MRN stations provided data from 82 rocketsonde observations during this period. D.S.G.

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N65-10025# Human Sciences Research, Inc., McLean, Va.
FLIGHT ANALYSIS OF APPROACH AND LANDING GUIDANCE ELEMENTS OF HELIPORT LIGHTING PATTERNS Final Report
David L. Watters, Wallace F. Rollins, Roger B. Frey, and Carl R. Cavonius Jun. 1964 191 p refs
(Contract FAA/BRD-401)
(RD-64-93)

The flight phase of a series of tasks directed at the development of preliminary design criteria for approach and landing guidance elements of a heliport lighting configuration is presented. Helicopter pilots flew approaches to 8 experimental lighting and marking patterns. Seventy-two measures of aircraft position, aircraft attitude, and pilot control movement were analyzed to identify measures sensitive to changes in lighting configuration, but insensitive to individual pilot technique. Those measures that successfully discriminated among different lighting conditions were measures of deviation from a generally accepted standard (e.g., a straight flight path during approach) as opposed to measures that reflect individual pilot technique. The vast majority of the recorded measures (particularly pilot control movement) reflected interpilot differences in technique, since individual pilots display great consistency when repeating the same pattern. Recommendations include investigation of lighting configurations that give the pilot immediate and unambiguous information when he deviates from a desired flight path, e.g., a system similar in concept to the fixed-wing mirror system. Other recommendations concern suggestions for planning, conducting, and processing performance data. Author

N65-10027# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering
COMPARISON OF HIGH-GAIN-LINEAR AND SELF-ADAPTIVE FLIGHT CONTROL SYSTEMS WITH NONLINEARITIES INTRODUCED
Henry M. Serex and James N. Holt (M.S. Thesis) Jun. 1964 200 p refs
(GGC/EE/64-11; AD-603953)

This report analyzes the operation of a high-fixed-gain linear flight-control system and a self-adaptive system, the MH-96 autopilot. The two systems are simulated on an analog computer for both linear and nonlinear operation. Saturation, backlash, and stiction are introduced, and both systems are found to operate satisfactorily. Using response criteria for high-performance flight vehicles, comparison of the two system designs shows that neither enjoys a clear advantage over the other, but the self-adaptive design is chosen as the preferred system because of its stability under disturbance conditions and its better limit cycle characteristics when backlash is present. Author

N65-10111*# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
ADVANCED SPACEBORNE DETECTION, TRACKING, AND NAVIGATION SYSTEMS STUDY AND ANALYSIS, VOLUME III, PART II: ANALYTICAL SOLUTION FOR THE LUNAR MISSION Compilation Report 1750C
Jul. 1964 310 p refs
(Contract NAS8-11205)
(NASA-CR-59414) OTS Prices: HC $7.00/MF $1.75

The problem investigated is the determination of navigation and control sensor requirements for local or onboard guidance of manned (or unmanned) lunar missions. Generally, the analytical solution takes the form of a determination of the degradation of navigation and control system performance caused by sensor inaccuracies. The principal measures of performance are terminal errors and fuel consumption. The information generated is examined in the light of allowable performance degradation to determine sensor accuracy requirements. As a part of the analytical solution, control and data processing methods, as well as mathematical analysis techniques, are selected, discussed, implemented (usually by means of digital computation), and evaluated. Author

N65-10324# Pickard and Burns Electronics, Waltham, Mass.
OMEGA—A WORLD-WIDE NAVIGATIONAL SYSTEM. SYSTEM SPECIFICATION AND IMPLEMENTATION
J. A. Pierce (Harvard U.), W. Palmer (Sperry Gyroscope Co.), A. D. Watt (Deco Electronics, Inc.), and R. H. Woodward 1 Jun. 1964 271 p refs
(Contracts Nonr 1866(07); Nonr 4173(00); Nonr 4107(00); Nonr 4105(00))
(P&B Publ.-886; AD-603764)

The purpose of the Omega system is to satisfy the requirement for global, all-weather navigation at an acceptable cost by establishing a worldwide VLF radio-locating system. A design plan is presented for a radio-locating facility providing worldwide position fixing of moderate (1-mile) accuracy by phase comparison of VLF (10 to 14 kc) continuous-wave radio signals from only eight strategically located transmitting stations for use by aircraft, ships, and land vehicles, and by submarines at moderate (40 to 50 feet) antenna depths. M.P.G.

N65-10849# Minneapolis-Honeywell Regulator Co., St. Petersburg, Fla. Aeronautical Div.

ANALYSIS OF THE APPLICATION OF IMAGE-FORMING PHOTOSENSORS TO WIDE FIELD-OF-VIEW DAYLIGHT STAR TRACKERS

Bartley F. Conroy Wright-Patterson AFB, Ohio, Res. and Technol. Div., 20 Aug. 1964 89 p refs
(Contract AF 33(657)-11694)
(AL-TDR-64-190; AD-604589)

This report analyzes the performance limitations of wide field-of-view (approximately one degree by one degree) daylight star-tracking systems employing image-forming photosensors. The star tracker was assumed to be an alinement reference for an inertial guidance system. Assumed system parameters are general enough to make results applicable to both air- and missile-borne applications, and to unrestricted operating altitudes. Author

N65-10852# Federal Aviation Agency, Washington, D.C. Systems Research and Development Service

AIRPORT SURFACE DETECTION EQUIPMENT (ASDE): OPERATIONAL EFFECTIVENESS WITH AND WITHOUT BRIGHT DISPLAY Final Report

Stanley H. Gaffen Oct. 1964 100 p refs
(RD-64-141)

Airport Surface Detection Equipment (ASDE) radar provides controllers with a means to observe surface-traffic movement. Major recommendations are as follows: Bright-daylight ASDE displays should not be developed and installed unless ASDE will remain in tower cabs for a long time; plans to survey (dispose of) some ASDE's suggest that this is unlikely. Bright ASR displays should be provided for tower cabs before bright ASDE displays. Consideration should be given to turning off some ASDE's and maintaining them in a mothball status. Author

N65-10861# Federal Aviation Agency, Atlantic City, N.J. Evaluation Div.

EVALUATION OF CLOSED-CIRCUIT TELEVISION FOR AIRPORT BLIND-SPOT SURVEILLANCE Final Report

Leonard C. Moore and Robert W. Delaney Sep. 1964 83 p refs
(RD-64-133)

An evaluation of closed-circuit television was conducted at the Municipal Airport No. 1, Salt Lake City, Utah, to determine the operational capabilities and limitations of the system when used for the surveillance of critical portions of airport operating areas that could not be observed directly by airport traffic controllers. Lightweight single-engine aircraft were observed throughout the test program. It was concluded that closed-circuit television can provide pictorial information suitable for blindspot surveillance of critical areas not directly visible from the Control Tower Cab of the airport. The principal operational limitations resulted from the need to maintain a stationary frame of reference, both day and night, and from the absence of depth perception. Author

N65-10863# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio

THE FEASIBILITY OF A VELOCITY-DAMPED INERTIAL NAVIGATION SYSTEM

Albert Ray Turley and Robert John Wilson, III (M.S. Thesis) [1962] 112 p refs
(GGC/EE/64-18; AD-603959)

A passive inertial-navigation system generates position information containing an oscillating error. Previous flight-test results of a gimballess navigator clearly indicate this unwanted oscillation. External velocity information, reduced from aerial photographs, is successfully employed in this study to damp the oscillation in flights under the same dynamic environment. Comparison of undamped and damped position-error curves proves velocity damping has little effect on average system error, but improves position uncertainty by approximately 43%. To optimize the inertial system for all flight conditions, the study results suggest a variable damping ratio. Values of 0.7 prior to takeoff, and between 0.07 and 0.1 after takeoff, are recommended. Author

N65-10867# Autonetics, Anaheim, Calif.

A COMPUTER MECHANIZED GENERAL ACCURACY ANALYSIS METHOD FOR AUTONAVIGATORS WITH MODE SWITCHING

Thomas W. De Vries 6 Mar. 1964 14 p Reprinted 27 Jul. 1964
(T4-320/3110)

A set of linear differential equations with piecewise constant coefficients is presented that closely approximates error propagations in an inertial autonavigator. Techniques for applying these equations to an autonavigation system operated with mode switching are derived. The problem is broken down into a number of well-defined computer operations, thus permitting extensive use of subroutines for comprehensive analyses of a wide variety of autonavigator configurations and operating modes, with small expenditures of time and money. The basic principles of the described computer technique have been incorporated into a routine that has been in satisfactory use for over a year. M.P.G.

N65-10873# Case Inst. of Tech., Cleveland, Ohio

A MIDCOURSE GUIDANCE PROCEDURE FOR ELECTRICALLY PROPELLED INTERPLANETARY SPACECRAFT

Alan L. Friedlander (M.S. Thesis) 1963 122 p refs

Linear perturbation techniques and the method of adjoint functions are employed to derive the fundamental guidance equations in the form of recursive-state transition relations. An optimal guidance policy, in the sense of minimizing a quadratic performance index involving the control forces and subject to the desired terminal conditions, is formulated. A celestial navigation scheme with measurements taken at discrete intervals is postulated as the primary mode of state determination. Utilizing a priori statistical information concerning the random disturbances and measurement errors, an optimal prediction and filtering procedure is formulated that yields the "best" up-to-date estimate of the state. Statistical expressions are derived for use in evaluating the integrated guidance theory. Numerical results of guidance performance are presented for a representative Earth–Mars transfer assuming circular, coplanar orbits. Author

N65-10948# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Oberpfaffenhofen (W. Germany) Inst. für Stewer- und Regeltechnik

INFLUENCE OF A FIRST ORDER DELAY ON THE PROPORTIONAL-NAVIGATION [EINFLUSS EINER VERZOGERUNG ERSTER ORDNUNG AUF DIE PROPORTIONAL-NAVIGATION]

R. Dierstein, A. Kutzer, D. Ortlieb, H. Schubert, and U. Schwellinger Mar. 1964 50 p refs *In* GERMAN; ENGLISH Summary
(DLR-FB-64-03; DVL-302) Available from DVL, Munich: 10 DM

These investigations on the influence of a single timelag on proportional navigation are carried out assuming that the attainable miss distance is most important for judging a missile's guidance system. The given operational conditions are taken into account. The miss distances are obtained by solving

the equations of the trajectories by electronic computers. Cases of angular launching errors (angular deviation from constant bearing course at launching) and of normal acceleration of the target, and limitations of the normal acceleration of the missile are investigated. Dealing with fundamental relations, these investigations are based on a considerably simplified missile system. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N65-10029# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM PROGRESS REPORT, SEPTEMBER 1964
R. M. Adams and A. Glassner 15 Oct. 1964 99 p refs
(Contract W-31-109-ENG-38)
(ANL-6944)

Technical progress is reported for the Borax-V boiling water reactor, and in the areas of fast-reactor physics, fuel, and fuel-reprocessing development. Various facets of the EBR-II are discussed. General reactor technological progress in the fields of physics, material and fuels development, remote control, heat engineering, chemical separations, and the plutonium recycle program is reviewed. Advanced systems research is reported for the Argonne Reactor, MHD, and regenerative EMF cells. A discussion of nuclear safety concerns thermal reactors, fast reactors, and the large TREAT loop. R.L.K.

N65-10030# Atomics International, Canoga Park, Calif.
SNAP 10A RADIATION SHIELD ANALYSIS
J. A. Belcher, W. A. Flynn, and R. J. Thomson 15 Oct. 1964 38 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-9647) OTS: $0.75

Preliminary analysis of the shield design indicated that the direct penetration dose at the 5-ft-diameter reference dose plane 17.5 ft from the lower face of the reactor core would meet the flight design objectives of 10^{12} nvt and 10^{7} R for one year of operation. Subsequent analysis indicated that due to scattering effects from the edges of control drums, the NaK piping around the shield, and the thermoelectric converter system, some regions of the dose plane would be exposed to doses beyond the specified limits. However, through judicious placement and hardening of radiation-sensitive instruments and the somewhat localized nature of the scattering effects, an increase in shield size for the SNAP 10A flight test was not warranted. This analysis employed conventional ray-tracing theory throughout. Technique, theory, computer codes, and parameters are discussed. In addition to computing radiation levels behind the shield, internal heat generation was determined. The results show that, for the particular combination of tolerance (10^{7} R), separation distance (17.5 ft), and reactor power (34 kW), specific gamma shielding was not required. LiH was selected as the fast neutron-shield material, since for a given neutron attenuation it provides the lightest weight shield. Author

N65-10031# Atomics International, Canoga Park, Calif.
SNAP FUEL REENTRY BURNUP EXPERIMENT IN A HYPERTHERMAL WIND TUNNEL
J. W. Baughn 15 Oct. 1964 81 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-9779) OTS: $2.00

Specimens of SNAP fuel material were tested in a simulated reentry environment. This behavior in this environment was observed and is described in this report. This behavior was compared to and agreed with computations using a simple thermal approximation to the fuel material. The behavior was also extrapolated directly to that of an orbital reentry (with release of the reactor fuel rods from the reactor vessel at an altitude of approximately 240000 ft). Author

N65-10211# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering
THE DESIGN OF A CRYOSTAT FOR THE AIR FORCE NUCLEAR ENGINEERING TEST FACILITY
Ernie Braunschweig (M.S. Thesis) Aug. 1964 131 p refs
(GNE/Phys/64-3; AD-603609)

A liquid helium cryostat for nuclear irradiation experiments was designed for use in the reactor beam tubes. Liquid helium consumption due to thermal heat transfer is reduced to 0.13 liter/hr by gas-cooled shields around the sample chamber and in the transfer line. The low consumption rate will allow operation using liquid helium from a storage dewar. Gamma radiation is the largest heat source in the cryostat, and must be reduced with a gamma shield. Fast neutron heating of the helium coolant is significant, and may limit the fast neutron flux to which the cryostat can be exposed to less than 10^{12} n/cm^{2}sec. Operating the cryostat with liquid helium in the reactor does not endanger reactor control or structure. The cryostat can be operated with a wide range of coolants, and can be readily modified for any sample chamber smaller than a cylinder 4 inches in diameter and 8 inches long. The adaptability of the cryostat and its low coolant consumption make it attractive for use in other reactors, and in irradiation experiments not performed in reactors. Author

N65-10261# Naval Research Lab., Washington, D.C. Metallurgy Div.
IN-REACTOR STUDIES OF LOW CYCLE FATIGUE PROPERTIES OF A NUCLEAR PRESSURE VESSEL STEEL Final Report
J. R. Hawthorne and L. E. Steele 27 Jul. 1964 19 p refs
(NRL-6127; AD-606773) OTS: $0.50

An experimental irradiation assembly and associated instrumentation, which have been developed and successfully utilized for the performance of dynamic in-reactor low cycle fatigue tests of reactor pressure vessel steels, are described. The equipment provides for the simultaneous reverse bend testing of as many as 15 sheet-type specimens representing a range of strain amplitudes at controlled temperatures in the range 300° to 700° F. The results of an exploratory investigation on the fatigue resistance of ASTM-type A302-B steel during irradiation at 500° F are presented and compared with data from out-of-reactor control tests. These preliminary data do not indicate any pronounced difference in the fatigue strength of irradiated versus unirradiated steel. Author

N65-10421# Atomics International, Canoga Park, Calif.
EVALUATION OF COOLANT IMPURITY REMOVAL EQUIPMENT AT THE OMRE
P. Barbour and W. W. Davis 15 Oct. 1964 119 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-8474) OTS: $2.50

The experimental application of centrifugal clarification, precoat filtration, conventional filtration, and adsorption to the removal of impurities from a bypass stream of irradiated reactor coolant is described and evaluated. Included is an evaluation of full-flow filtration of the reactor coolant through a 40-micron woven-wire filter. Some aspects of the theory of cleanup equipment performance are also discussed. The data indicate that, of the methods studied, combined bypass filtration through 2- to 3-micron glass-spool cartridge filters and fixed-bed adsorption employing attapulgus clay shows the most promise for maintaining organic reactor coolant in a nonfouling condition during reactor power operation. Author

N65-10492# Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J. Solid State and Frequency Control Div.

DESIGN THEORY FOR LASER AMPLIFIERS

H. Jacobs, F. A. Brand, S. Weitz, and C. Lo Cascio Jul. 1964 46 p refs

(TR-2486; AD-607057)

It was predicted in earlier work that for a given length of crystal where there are multiple reflections, the transmitted gain would rise with negative attenuation, reach a maximum and then reverse its direction, decreasing rapidly at first, and then gradually approaching an asymptotic value of zero. In the present writing experiments have been initiated to investigate the validity of the theory using ruby at liquid nitrogen temperatures. A transmission system was set up with an oscillator, a filter, an amplifier, and a detector. By controlling the relative time delays in firing or by changing the power input to the amplifier, the properties of transmitted power gain were studied. It was found that both the oscillator and amplifier rubies in uncoated form could be made to oscillate for about 100μsec giving a well-defined pulse of quasi-cw operation. The gain of the amplifier increased as the times of the signal from the oscillator approached the time at which the amplifier went into oscillation. Author

N65-10518# New Mexico State U., University Park Research Center

VARIATION OF REFRACTIVE INDEX DURING LASER OPERATION Semiannual Technical Report

J. R. Izatt, H. A. Daw, and R. C. Mitchell Jul. 1964 30 p refs

(Contract Nonr-3531(04))

(SATR-2; AD-603450)

Experimental determination of the effect of optical pumping on the refractive index of ruby in the region of anomalous dispersion surrounding the R_1 line requires a ruby sample of high optical quality. Shadowgraph and small-angle scattering measurements combined with some interferometric measurements in which the ruby serves as the spacer in a Fabry–Perot etalon indicate that a small Linde ruby has sufficient optical quality to allow accurate measurements of the minute index changes that are anticipated, i.e., changes smaller than 1 part in 10^4. The experimental approach used was to measure the refractive index changes requires photographing a set of Fabry–Perot fringes, whose relative positions are determined by the index changes, against a background set of fringes that serve as fiduciary marks. The feasibility of extracting quantitative information from the composite fringe patterns depends on the detailed spectral structure of the light that produces the fringes and also on rather critical control of relative exposure. Author

i-10547# European Atomic Energy Community, Brussels gium)

CTRON MICROPROBE ANALYSIS OF NUCLEAR MAIALS

R. Theisen *In its* EURATOM's Sci. Activities – Joint Nucl. Res Center, Ispra Establ. 1964 26 p refs (See N65-10541 01-23) Available from the Belg. Am. Bank and Trust Co., N.Y., Accoun No. 22.186: 450 Belg. Fr.

X-ray microanalytical methods must be adapted for use in nuclear-materials research. The extension of electron-microprobe analysis to cover trace analysis and quantitative determinations in the presence of radioactive materials is described. Quantitative evaluation methods in the presence of the heavy elements—uranium and plutonium—have been developed, the resultant calculated values concurring with experimental determinations of calibration standards. The applications include studies of intermetallic diffusion, radiation damage, corrosion mechanisms, phase transformation, and localized structural analysis. Author

N65-10548# European Atomic Energy Community, Brussels (Belgium)

DIRECT ENERGY CONVERSION BY THERMIONIC EMISSION

H. Neu, J. Bohdansky, C. Busse, C. Cappelletti, R. Caron et al *In its* EURATOM's Sci. Activities—Joint Nucl. Res. Center Ispra Establ. 1964 25 p refs (See N65-10541 01-23) Available from the Belg. Am. Bank and Trust Co., N.Y., Account No. 22.186: 450 Belg. Fr.

Two in-pile tests with experimental converters have been carried out with the maximum electrical power output being about 40 watts, with a conversion efficiency of about 11%. The behavior of the emitter heating system used in the in-pile experiment (Mo emitter heated by radiation from a (UZr)C fuel pin) was studied out-of-pile, where nuclear-fission heat was simulated by electron bombardment. The change in the emitter work function due to evaporated fuel was measured under different conditions of fuel outgassing and at different temperatures. The maximum obtainable efficiency of in-pile converters with high cesium-vapor pressure and refractory-metal emitters is discussed. According to the conclusions reached, about 14% could be achieved with a reemitter at 1800° K and an interelectrode spacing of 0.24 mm. Higher efficiencies are probably to be expected with absorbed electronegative gas layers on the emitter or collector surface. The results of a preliminary analysis of fast-reactor sizes and performances for various converter cell geometries are given. Author

N65-10606# California U., Livermore Lawrence Radiation Lab.

CORROSION OF BERYLLIUM OXIDE BY WATER VAPOR

A. Maimoni 4 Sep. 1964 36 p refs

(Contract W-7405-ENG-48)

(UCRL-7663)

Beryllium oxide has been used as a structural and moderating material for a number of high-temperature, air-cooled reactors; however, for open-cycle applications, its reaction with water vapor can lead to losses of moderator material from the high-temperature regions of the reactor core and to subsequent deposition in the cooler regions. A comparison is made between the calculational method and reported experimental determinations of the corrosion and deposition of BeO. The calculational scheme can predict the amount of BeO deposited as a smooth layer on the inside of the tube, although qualitative experimental results show that deposition takes place by growth of isolated crystals. The logic and operating procedure for the HOT HOLE program, written for an IBM-650, is presented. Experimental corrosion profiles are compared with HOT HOLE results and show reasonable agreement. D.S.G.

N65-10808# Technische Hogeschool, Eindhoven (Netherlands) Lab. of Heat Transfer and Reactor Engineering
THEORETICAL AND EXPERIMENTAL RESULTS ON STEADY STATE BOILING IN AN ANNULAR GEOMETRY
C. L. Sprigt, F. J. M. Dijkman, J. D. Callen, and M. Bogaardt Brussels, EURATOM, 1964 40 p refs Presented at the EAES-Symp., Studsvik, Sweden, 1–3 Oct. 1963
(Contract 032-60-11-RDN)
(EUR-1456.E; EURAEC-856) Available from the Belgium. Bank and Trust Co., N.Y., Account No. 22.186: 60 Belg. Fr.

A description is given of the results obtained on the natural circulation boiling loop. Mass flow and void fraction are reported as a function of input power, pressure, and inlet subcooling for an annular geometry. The results are compared with a mathematical model that has been constructed for this loop. The model takes care of the of the effects of the phase losses, slip, subcooled boiling, and of the axial variation of saturation temperature of the liquid. Author

N65-10659# Argonne National Lab., Ill.
DATA RELATING TO THE PRODUCTION OF TRANSCURIUM ELEMENTS IN HIGH NEUTRON FLUXES
D. C. Stewart, R. W. Anderson, and John Milsted Sep. 1964 26 p refs
(Contract W-31-109-ENG-38)
(ANL-6932)

This is a report on calculated yield curves with modified cross section and decay half-life values, showing the formation rates and levels of production of the very heavy nuclides when certain transneptunium isotopes are exposed for varying lengths of time in a series of high neutron fluxes. The computer programs used in calculating these new yield curves have been extended and modified to obtain additional data pertaining to encapsulating, irradiating, and processing of the four target materials: plutonium, americium, curium^{244}, and californium^{252}. It was found that a large amount of any of the targets ended up as fission products rather than as the sought-for element. G.G.

N65-10853# General Dynamics/Convair, San Diego, Calif.
ANALYSIS OF AIRBORNE NUCLEAR SHIELDING DATA I, CONFIGURATION I
L. C. Thompson 7 Aug. 1957 73 p refs
(Contract AF 33(600)-32054)
(NARF-57-32T; FZK-9-111; AD-422418)

This report presents an analysis of the fast-neutron and gamma dose rates measured during two Nuclear Test Airplane flights and during one ground experiment. In all cases, ASTR Configuration 1 (minimum shielding) was used. The experimental data show that air density has a marked effect on the dose rates, and that a linear relationship exists between dose rate and air density within experimental error. Comparison of dose-rate calculations with measurements shows that the method of calculating the fast-neutron dose rate outside the shielded compartments is reasonably good, but that the method of calculating fast-neutron crew-shield penetration is inadequate. The predicted gamma dose rates are much less than the measured dose rates, primarily because of inadequate measurements of the thermal flux. Author

N65-10868# Atomics International, Canoga Park, Calif.
BOILING STUDIES FOR SODIUM REACTOR SAFETY PART II: POOL BOILING AND INITIAL FORCED CONVECTION TESTS AND ANALYSES
H. Lurie and R. C. Noyes 15 Oct. 1964 81 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-9477) OTS: $2.00

In fulfillment of the general objective of developing information on two-phase flow required in the safety evaluation of sodium cooled reactors, pool- and forced-convection boiling of sodium were studied both experimentally and analytically. Presented are recent results obtained on the pool-boiling characteristics and the critical heat flux of saturated sodium between 0.5 and 8 psia, and also on the forced convection boiling characteristics and critical heat flux for pressures of 2 and 5 psia, flow rates of 0.75 to 3 gpm, and average subcoolings of 5° to 116° F. Critical-heat-flux measurements for pool boiling on a cylindrical heater ranged from 300 000 to 1 000 000 Btu/hr-ft^2, and increased with the absolute pressure to the 0.17 power. This value is considerably lower than would be expected on the basis of results available for other liquids and on the basis of theoretical predictions. A modified, general, nondimensional correlation incorporating these data is presented. Author

N65-10882# IIT Research Inst., Chicago, Ill.
STUDIES OF REACTOR CONTAINMENT STRUCTURES Summary Report, 1 May 1962–31 Jan. 1963
N. A. Weil, M. A. Salmon, R. L. Chiapetta, H. S. Napadensky, and W. D. Pilkey [1963] 367 p refs
(Contract AT(11-1)-578)
(IITRI-578P22-9) OTS: $4.50

This paper describes various methods for the analysis of the following: (1) the static strength of cylindrical shells with various end closures; (2) the analytical studies of thin plates, spherical shell caps, and shallow cylindrical shells to determine the effects of unreinforced and reinforced circular openings on their behavior in the plastic range; (3) the evaluation of newly developed instrumentation methods to measure the various bulging effects on pressurized cylinders of finite lengths that consist of a low-carbon steel, a high-strength low-alloy steel, or an austenitic stainless steel; and (4) the development of a containment vessel handbook that correlates the produced material. G.G.

N65-10923# Aerojet-General Nucleonics, San Ramon, Calif.
APRA FACILITY NUCLEAR CRITERIA
J. P. Lehman, R. L. Tomlinson, H. M. Hagaman, and D. E. Johnson 1964 43 p
(Contract DA-04-200-ORD-1135(R))
(AN-1220; AD-451202)

Design criteria for the facility construction drawing for the Army Pulsed Reactor Assembly (APRA) are presented. Emphasis is placed on the proposed experimental test equipment and on the characteristics of the pulsed reactor, consisting of seven concentric fueled cylindrical shells of uranium that have been enriched to 93% in U^{235} and alloyed with 10 wt% molybdenum. A detailed description of the reactor site is also presented. G.G.

N65-10932# Atomics International, Canoga Park, Calif.
SODIUM REACTOR EXPERIMENT, REACTIVITY HISTORY PROGRAM
L. M. Weaver, III 15 Oct. 1964 24 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-10010) OTS: $0.75

A calculational technique has been developed for use as an analytical tool for surveillance of the sodium-reactor-experiment (SRE) nuclear performance. This program specifically makes a comparison of the excess calculated reactivity and the measured reactivity determined from the positions of the calibrated shim rods. Variations and changes in reactivity differences are investigated on the basis of changes in operating parameters. The reactivity history program has been successfully used for SRE Core II nuclear analysis. Author

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N65-10048# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS
William M. Leak, ed. Apr. 1964 41 p refs
(AD-605709) OTS: $1.25

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8. SOLID STATE PHYSICS L. S. Birks et al p 32–34 refs

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N65-10076# Joint Publications Research Service, Washington, D.C.
IZVESTIYA VUZov: RADIOPHYSICS, NO. 2, 1964
19 Oct. 1964 283 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (Gor'kiy), v. 7, no. 2, Mar.–Apr. 1964 p 193–388
(JPRS-26953; TT-64-51209) OTS: $6.00

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25. SCATTERING OF A LIGHT BEAM IN A LAYER OF A CLOUDY MEDIUM L. S. Dolin p 267–271 refs (See N65-10101 01-23)

26. SOME PROBLEMS IN THE THEORY OF OPERATING RELIABILITY OF A CYCLIC AUTOMATIC DEVICE V. I. Zakharov p 272–277 refs (See N65-10102 01-10)

27. LETTER TO THE EDITOR V. M. Fayn, Ya. I. Khanin, and E. G. Yashchin p 278–279 ref (See N65-10103 01-23)

28. ABSTRACTS OF ARTICLES OF INTEREST TO READERS OF RADIOPHYSICS p 280–282

N65-10089# Joint Publications Research Service, Washington, D.C.
MEASUREMENT OF THE SPACE DISTRIBUTION OF REFRACTION INDEX FLUCTUATIONS WITH THE AID OF A LENS
F. A. Markus and A. M. Cheremukhin *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 147–155 refs (See N65-10076 01-23) OTS: $6.00

Results are given of the investigation of the space distribution of refractive index fluctuations for visible light. An estimate of the minimum dimensions of the inhomogeneities detected in the medium is given for the refractive index. Author

N65-10090# Joint Publications Research Service, Washington, D.C.
THE SCINTILLATION OF SOURCES OF FINITE ANGULAR DIMENSIONS
A. I. Kon and V. I. Tatarskiy *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 156–165 refs (See N65-10076 01-23) OTS: $6.00

The problem of light-intensity fluctuation of a remote source of finite angular dimensions located outside of the refracting atmosphere is considered. The calculation is carried out allowing for the diffraction effects, since for a thickness of the refracting medium of $L >> l_0^2/\lambda$ (l_0 is the inner scale of turbulence, λ is the wavelength), the application of geometrical optics does not give satisfactory results. Author

N65-10091# Joint Publications Research Service, Washington, D.C.
SOME PROBLEMS IN THE THEORY OF QUASI-OPTICAL SYSTEMS
N. G. Bondarenko and V. I. Talanov *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 166–187 refs (See N65-10076 01-23) OTS: $6.00

On the basis of a diffusion approach to the description of wave beams in quasi-optical systems, the laws of transformation of wave beams by infinite plane field transformers are found. The problem of the detection of the configurations of wave beams providing the energy transfer between two given transformer apertures with minimum losses is considered, as well as the relation between such optimum configurations and the field distributions in beam wave guides and resonators. The methods of describing the oblique beams in beam mirror waveguides are given, and some characteristics of such waveguides are investigated. Author

N65-10094# Joint Publications Research Service, Washington, D.C.
OUTWARD PARTIAL CONDUCTIVITIES OF A NARROW RECTILINEAR OPENING IN A PLANE SCREEN
B. A. Panchenko *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 212–224 refs (See N65-10076 01-23) OTS: $6.00

Formulas for the calculation of the outward conductivities of narrow openings in a conducting screen were obtained. Sines were chosen as the coordinate functions of the varying field along the opening with a period multiple to π/a (a is the length of the opening). The field variation across the opening is calculated by means of introducing an equivalent opening width. Graphs of the partial conductivities for various dimensions of the opening are given; these graphs may be used for computing the impedance characteristics of a slot antenna. Author

N65-10096# Joint Publications Research Service, Washington, D.C.
ON ONE TYPE OF RELAY SYSTEM BIFURCATION
Yu. I. Neymark and M. I. Feygin *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 233–251 refs (See N65-10076 01-23) OTS: $6.00

Possible configurations in parameter space of regions of various periodic relay-system motions are examined on the assumption that the unique bifurcations of the periodic motion under consideration are due to the arrival of a phase trajectory at the boundary of a sliding-motion plate, and that for each value of the parameters, there is a unique periodic motion. The desirability of such an analysis is illustrated by an investigation into the periodic motions of a dry-friction damper. Author

N65-10101# Joint Publications Research Service, Washington, D.C.
SCATTERING OF A LIGHT BEAM IN A LAYER OF A CLOUDY MEDIUM
L. S. Dolin *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 267–271 refs (See N65-10076 01-23) OTS: $6.00

The dispersion of a bounded light beam in a layer of a cloudy medium is considered, with the assumption that the indicatrix $G(|n - m|)$ is extended sharply in the direction of the incident rays, while the radiation intensity $I(r,n)$ in the entire layer satisfies certain given conditions. It is shown that the beam cross section at any given depth is determined solely by the scattering index and does not depend on the true absorption index, whereas the total energy flux depends only on the absorption index. D.E.W.

N65-10147# Joint Publications Research Service, Washington, D.C.
ON THE PROPERTIES AND ADJUSTMENT OF DOUBLE (ANGLE) MIRRORS
G. V. Pogarev *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 157–170 refs (See N65-10126 01-14) OTS: $6.00

The matrix of the double mirror is obtained and is used to find the general expression for the direction of the reflected rays, the angle of tilt, and for the angle of rotation of the image. Equations are derived for the shift and defocusing of the image for movements of the double mirror in a converging path of rays. The solutions of some practical problems are given.
Author

N65-10148# Joint Publications Research Service, Washington, D.C.
ANALYSIS OF THE ABERRATIONS OF OPTICAL SYSTEMS WITH DECENTERED PUPILS
Yu. A. Utekhin *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 171–180 refs (See N65-10126 01-14) OTS: $6.00

The effect of a decentered pupil on the aberration of an optical system is described. It is shown that in systems with decentered pupils the aberrations will be present even though the corresponding Seidel coefficients are equal to zero. Author

N65-10207# Michigan U., Ann Arbor Radiation Lab.
[SPHEROIDAL GEOMETRY APPLIED TO DIFFRACTION AND RADIATION PROBLEMS] Final Report
Frederick B. Sleator Jun. 1964 12 p refs
(Grant AF-AFOSR-289-63)
(Rept.-5603-1-F; AD-602787) OTS: $1.00

An investigation carried out to develop and to exploit new relations between the spheroidal functions and other, better-known functions is discussed. It is hoped that the relationships will reduce the labor and complication involved in obtaining

new numerical values of the spheroidal functions, and thus will facilitate the quantitative solutions of new spheroidal diffraction problems, or the extension of existing solutions, into ranges not previously covered. P.V.E.

N65-10287# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
QUANTUM NATURE OF LIGHT AND INTERCONNECTION OF SIGHT CHARACTERISTICS
V. K. Kagan 24 Sep. 1964 17 p refs Transl. into English from Svetotekhnika (Moscow), no. 5, 1962 p 7–12
(FTD-TT-64-489/1; AD-607141)

This study regards the conformities to the vision law as general consequences of the quantum nature of light and the statistical fluctuations of the photon flux, which are brought about by the specific peculiarities of the eye. A general formula was developed to solve the problem of revealing an object in an established process of observation. The quantum theory was used to establish a connection among the following factors—probability of distinguishing, the time of observation, the characteristics of the form of the object, and the photometric magnitudes. G.G.

N65-10347# Boeing Scientific Research Labs., Seattle, Wash.
ON THE HARMONIC OSCILLATION OF A RIGID BODY ON A FREE SURFACE Flight Sciences Laboratory Report No. 91
W. D. Kim Oct. 1964 73 p refs
(D1-82-0378)

The present paper deals with the practical and rigorous solution of the potential problem associated with the harmonic oscillation of a rigid body on a free surface. The body is assumed to have the form of either an elliptical cylinder or an ellipsoid. The use of Green's function reduces the determination of the potential to the solution of an integral equation. The integral equation is solved numerically, and the dependency of the hydrodynamic quantities of the rigid body on the frequency of the oscillation is established. Author

N65-10472# New York U., N.Y. School of Engineering and Science
SOME SPECULATIONS ON ELECTROMAGNETIC THEORY
H. H. Chiu 13 Jul. 1964 14 p refs
(Grant AF-AFOSR-178-64)
(NYU-AA-64-2; AD-607262)

An attempt is made to derive Maxwell's equation of an electromagnetic field, in vacuo, from the relativistic Liouville equation for the photon gas. The density distribution of the photon gas is conceived as the scalar product of two complex vector functions $\overline{\chi}$ and $\overline{\chi}^*$, which are conjugate to each other. By limiting the observation to be isotropic, in a sense described by K. Kondo, it was found that half of the sum of two complex wave functions is identified as the electric field intensity, whereas half of the difference of the two functions, divided by $\sqrt{-1}$ is the magnetic field intensity. The two vector wave functions satisfy Maxwell's equation of electromagnetic wave in vacuo. Author

N65-10500# Naval Research Lab., Washington, D.C. Dosimetry Branch
PRESENT STATUS OF DOSIMETRY BY RADIOPHOTOLUMINESCENCE AND THERMOLUMINESCENCE METHODS
F. H. Attix 18 Sep. 1964 29 p refs
(NRL-6145; AD-607356) OTS: $0.75

This reviews the present status of dosimetry by radiophotoluminescence and thermoluminescence devices, and includes principles of operation, types of glasses or phosphors available, types of luminescence-measuring instruments, dose-ranges, precision and linearity obtainable, time-stability of dosimeter response, temperature effects during irradiation and storage, dependence upon absorbed dose rate, dependence of response per roentgen upon the effective quantum energy of γ-radiation, response to neutrons, and dependence of response per rad upon linear energy transfer (LET). A brief historical review of each system is presented. Recent developments in infrared stimulable phosphors for dosimetry are also mentioned. A reference list of 97 items is given. Author

N65-10541# European Atomic Energy Community, Brussels (Belgium)
EURATOM'S SCIENTIFIC ACTIVITIES—JOINT NUCLEAR RESEARCH CENTER, ISPRA ESTABLISHMENT
1964 360p refs
(EUR-1643.e) Available from the Belg. Am. Bank and Trust Co., N.Y., Account No. 22.186: 450 Belg. Fr.

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22. THE EFFECT OF LATTICE IMPERFECTIONS ON THE INTENSITIES DIFFRACTED BY NEARLY PERFECT CRYSTALS R. Colella, A. Merlini, S. Pace, and E. van der Voort 15 p (See N65-10544 01-26)

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24. PRODUCTION OF STEADY-STATE EXCESS CONDUCTIVITY DURING PLASTIC DEFORMATION OF ALKALI HALIDES P. Camagni and A. Manara 10 p (See N65-10545 01-26)

25. STUDY OF SOME LUMINESCENT EMISSIONS OF X-IRRADIATED ALKALI HALIDES M. Boni and P. Camagni 10 p refs (See N65-10546 01-26)

26. ELECTRON MICROPROBE ANALYSIS OF NUCLEAR MATERIALS R. Theisen 26 p refs (See N65-10547 01-22)

27. DIRECT ENERGY CONVERSION BY THERMIONIC EMISSION H. Neu, J. Bohdansky, C. Busse, C. Cappelletti, R. Caron et al 25 p refs (See N65-10548 01-22)

28. MOLTEN SALT CHEMISTRY IN FLUORIDE AND CHLORIDA MELTS V. Lungagnani, S. Pizzini, and G. Sternheim 19 p refs

29. THE EURATOM TRANSPLUTONIUM PROGRAMME J. Kooi 18 p

N65-10591# Aerospace Corp., El Segundo, Calif.
A FUNCTIONAL EQUATION APPROACH TO A PROBLEM OF LOW THRUST MOTION
B. H. Billik 24 Jul. 1963 20 p refs
(Contract AF 04(695)-169)
(TDR-169(3550-30)TN-1; SSD-TDR-63-235; AD-422639)

The radial acceleration program that minimizes the propellant required by a vehicle to transfer from some given initial state to one of a certain class of preassigned final states in a given time is obtained, through the use of both dynamic programing techniques and the calculus of variations. The optimum acceleration program is shown to vary both secularly and periodically with the central angle. In addition, the equations of motion are solved, thus indicating the trajectory flown by the vehicle under the aforementioned thrust program. An application to orbital rendezvous problems is briefly discussed. Author

N65-10642*# National Aeronautics and Space Administration, Washington, D.C.
DETERMINATION OF THE PARAMETERS OF A SPACECRAFT'S MOTION BASED ON DATA OF TRAJECTORY MEASUREMENTS [OPREDELENIYE PARAMETROV DVIZHENIYA KOSMICHESKOGO LETATEL'NOGO APPARATA PO DANNYM TRAYEKTORNYKH IZMERENIY]
E. L. Akim and T. M. Eneyev Nov. 1963 58 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 1, Jul.-Aug. 1963 p 5-50 Previously Announced as N64-21627 15-29
(NASA-TT-F-8560) OTS Prices: HC $2.00/MF $0.50

A method is offered for determining the parameters of a spacecraft's motion based on the data obtained from trajectory measurements. An algorithm is also suggested for estimating the accuracy of forecasting the vehicle's motion, based on the results of processing the trajectory measurements. The method is intended for use in universal high-speed computers. Author

N65-10894# Brown U., Providence, R.I. Mathematics Div.
THE MECHANICS OF MATERIALS WITH STRUCTURE
A. E. Green and R. S. Rivlin Jul. 1964 17 p refs
(Contract Nonr-562(10))
(TR-94; AD-603568)

This is a study of an extended classical continuum mechanics theory and its use in the description of a deformation by tensor fields of various orders, and in defining the associated forces as the coefficients of three tensors in a workable formula. The case of a single bound vector displacement and a single bound tensor of each order 2,..., μ is considered in a vector displacement field. The vectors and tensors bound at the centers of mass of the various regions into which the body was divided were displaced by continuous vector and tensor fields possessing as many spatial derivatives as may be required. These are then taken as a description of the deformation of a body. G.G.

N65-10924# Texas Western Coll., El Paso Schellenger Research Labs.
METEOROLOGICAL DATA REDUCTION AND ANALYSIS, SOUND PROPAGATION IN THE SHADOW ZONE, AND TEMPERATURE SENSING THIN FILM RESEARCH
20 May 1964 30 p refs
(Contract DA-29-040-ORD-2410)
(AD-451209)

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1. DATA REDUCTION AND ANALYSIS WORK 2 p
2. SOUND PROPAGATION IN THE SHADOW ZONE EXPERIMENT J. R. Provencio 10 p
3. THIN FILMS FOR TEMPERATURE SENSING LOW PRESSURE GASES (HIGH ATMOSPHERE TEMPERATURE MEASUREMENTS) Klaus Weimer, Charles Wilson, and Claude Karstendiek 16 p refs

N65-10926# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.
ELEMENTS OF THE THEORY OF NONLINEAR OPTICAL PHENOMENA
J. William Foreman, Jr. Oct. 1964 41 p refs
(R-117)

A brief outline of the theory of nonlinear optical phenomena is presented, together with some relevant experimental results that support the theory. After an elementary treatment of optical second-harmonic generation and a discussion of the properties of the macroscopic nonlinear susceptibility tensor, the basic equations that govern second-harmonic generation are obtained. The solutions of these equations in both the phase-matched and phase-mismatched cases are discussed. The process of phase velocity matching in negative uniaxial crystals is discussed in detail both for second-harmonic generation and sum frequency generation. The report concludes with a brief mention of some higher order nonlinear optical effects. Author

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N65-10156# Naval Ordnance Lab., Corona, Calif.
PURE PAIR COUPLING EXEMPLIFIED BY THE 5*g* LEVELS OF THE NOBLE GASES
Curtis J. Humphreys and Edward Paul, Jr. *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 16–28 refs (See N65-10155 01-29)

The first spectra of all the noble gases have been observed, described, and interpreted in the 4μ region. Except for scattered Ritzian combinations of levels of different origin, the observed features are accounted for as transitions between levels originating in the 4*f* and 5*g* configurations, respectively. By application of theoretical formulas developed by others, the 5*g* levels of NeI, ArI, and KrI may be shown to be examples of pair coupling completely developed within the limits of observational error. Author

N65-10157# Lund U. (Sweden)
THE SiI-SPECTRUM IN THE PbS-REGION
U. Litzén *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 29–36 refs (See N65-10155 01-29)

Following a description of the techniques used to measure the SiI spectrum in the PbS region, particularly the use of a condensed hollow cathode discharge in pure SiF_4 as the light source, tables of laboratory data on the observed lines are presented. The wavelength tables also indicate the difference between the observed wave numbers and the wave numbers that can be calculated from the term system in "Atomic Energy Levels," and from comparisons with solar data. Fifty-five earlier identifications are confirmed, and eight new solar lines are identified as SiI-lines. M.P.G.

N65-10158# Ohio State U., Columbus Lab. of Molecular Spectroscopy and Infrared Studies
HIGH RESOLUTION INFRARED SPECTRA OF SMALL POLYATOMIC MOLECULES
K. Narahari Rao *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 39–41 refs (See N65-10155 01-29)

Extensive studies of the infrared spectra of CH_4, NH_3, and H_2O molecules and their isotopic species are reported. During these studies of the vibration rotation bands in the infrared spectrum between 1μ and 20μ, it was found that the experimental work could be speeded up by employing coarse echelle-type gratings (40 grooves per mm) in higher spectral orders. The use of coarse eschelles also permits effective use of CO absorption standards. M.P.G.

N65-10159# Oxford U. (Gt. Brit.) Clarendon Lab.
THE TOTAL ABSORPTANCE OF THE 4.7 μ CO BAND
J. H. Shaw and J. T. Houghton *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 42–52 refs (See N65-10155 01-29)

The total absorptance of the 4.7μ band of CO has been measured for wide ranges of CO concentrations and total pressures using N_2 as the broadening gas. The total absorptance can also be calculated from the positions, strengths, widths, and shapes of the lines contributing to this band. The calculated absorptances are consistently smaller than the measured values. Better agreement is obtained if the line widths are arbitrarily increased by approximately 25%. Author

N65-10161# Tennessee U., Knoxville
A STUDY OF SPECTRAL LINE SHAPES AND SHIFTS
Alvin H. Nielsen *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 59–72 (See N65-10155 01-29)

Measurements of the self-broadening of HF at 100°C at pressures not exceeding 5 atm are reported. A computer method for correcting the measured absorption data for the broadening introduced by the finite slit of the spectrometer is described. Results discussed include the shifts of the lines with pressure and the necessity for modifying the form of the Lorentz formula to produce a good fit of the observed data. M.P.G.

N65-10162# Paris U., Orsay (France) Laboratoire d'Infrarouge
INFRARED FLUORESCENCE OF THE GASES CO_2 AND N_2O STIMULATED BY ACTIVE OZONE [FLUORESCENCE INFRAROUGE DES GAZ CO_2 ET N_2O PROVOQUEE PAR L'AZOTE ACTIVE]
F. Legay and P. Barchewitz *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 74–78 refs In FRENCH (See N65-10155 01-29)

Experiments demonstrating the possibility of a transfer of energy by collision from a vibrationally excited N_2 molecule to CO_2 or N_2O molecules are described. This transfer is shown to be particularly easy for CO_2 where an excitation to one or more quanta of the vibrational state ν_3 occurs by means of the active N_2. M.P.G.

N65-10398# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NUCLEAR RESONANCE SPECTRA OF ISOPROPYL COMPOUNDS SPECTRA OF TYPE A^6B AND A^6BX
J. Ranft 22 Sep. 1964 37 p refs Transl. into ENGLISH from Ann. Physik (Leipzig), v. 10, no. 1–2, 1962 p 1–30
(FTD-TT-64-537/1+2; AD-607157)

Formulas are presented for A^6B- and A^6BX-type spectra. The A^6B spectrum was tabulated for various values of the parameter $\lambda = J/\delta\mu_0$. Nuclear resonance spectra of several isopropyl compounds were also evaluated. The measured isopropyl coupling constants are approximately proportional to the electronegativities of the substituents. Author

N65-10549# Argonne National Lab., Ill.
INTERVAL DISTRIBUTION IN CORRELATED (PARENT-DAUGHTER) DECAY. ESTIMATION OF DAUGHTER HALF-LIFE
John A. Crawford Aug. 1964 15 p ref
(Contract W-31-109-ENG-38)
(ANL-5772) OTS: $1.00

An electronic circuit known as an interval selector is used in conjunction with an ionization chamber to count the number of intervals between successive ionizing alpha particles that are smaller than a given time τ that can be varied from 3×10^{-5} sec to approximately 0.2 sec. The paper gives the theory of the counting rate of the interval selector when the sample used contains a very short-lived parent–daughter combination. An experimental procedure is then given for the measurement of this short lifetime in terms of counting rates obtained on the interval selector. Author

N65-10556# California U., Berkeley Lawrence Radiation Lab.
STUDY OF OPTICAL-PUMPING TRANSIENTS IN RUBIDIUM AND CESIUM VAPORS
Joseph Yellin, Richard Marrus, and W. A. Nierenberg 4 Sep. 1964 20 p refs
(Contract W-7405-ENG-48)
(UCRL-11636)

The shapes of optical-pumping transients in rubidium vapor were studied in detail. Observed transients can be separated into a sum of exponential components. The components are found to be in agreement with a theoretical model based on complete mixing in the exicted state. From a study of the times of the individual components as a function of light intensity, relaxation times can be deduced. Author

N65-10587# Argonne National Lab., Ill. Applied Mathematics Div.
THE ANALYSIS OF COMPLEX GAMMA-RAY SPECTRA
William J. Snow Jul. 1964 25 p refs
(Contract W-31-109-ENG-38)
(ANL-6908)

An IBM-704 program has been written to increase the precision of the determination of the relative intensities and energies of gamma rays in a complex spectrum observed following neutron capture in neutron resonances. The quantity chi-square is formed for the complex spectrum in as many as 10 resonances, and minimized simultaneously with respect to all unknown intensities as well as the unknown gamma-ray energies. This simultaneous treatment makes use of the wide Porter–Thomas fluctuations in the intensities of the gamma ray to fix the gamma-ray energies. Author

N65-10604 European Organization for Nuclear Research, Geneva (Switzerland)
SU_3 AND WEAK INTERACTIONS [SU_3 ET INTERACTIONS FAIBLES]
Bernard d'Espagnat 24 Sep. 1964 84 p refs *In* FRENCH
(CERN-64-42)

Lecture notes from a series of seminars on SU_3 and weak interactions are presented. Among the topics discussed are these: (1) principal experimental and theoretical foundations; (2) theories of schizon and veton, and the distinction between them; (3) the contribution of certain poles and dynamic schemes; (4) groups and weak interactions; (5) unitary symmetry and nonleptonic interactions; (6) weak leptonic interactions; (7) nonleptonic interactions, hypotheses of the invariance of R or RP; (8) nonleptonic interactions without R invariance; and (9) intermediary bosons and unitary symmetry. M.P.G.

N65-10689*# Geneva U. (Switzerland) Inst. of Theoretical Physics
THE DOUBLE-PERIPHERAL MODEL, AND ITS APPLICATION TO INELASTIC PION–NUCLEON COLLISIONS
James Joseph (St. John's U., New York) and Hartmut Pilkuhn (European Organ. for Nucl. Res.) 23 Mar. 1964 26 p refs Submitted for Publication
(Grant NsG-171)
(NASA-CR-59456; Rept.-8591/TH-414) OTS Prices: HC $3.00/MF $0.50

The double-peripheral model is discussed and applied to four pion–nucleon reactions producing, respectively, a π^0, π^+, ω, and ζ^0. The results for the first two reactions are compared with a recent experiment at 4 GeV/c, and some additional predictions are given. Author

N65-10808# Nihon U., Tokyo (Japan)
GENERATED UNITARITY RELATIONS AND DYNAMICAL SINGULARITIES
Toshiharu Kawai (Tokyo U.) and Naohiko Masuda [1964] 26 p refs
(NUP-64-13)

Starting from the two-channel unitarity relations (one channel consists of two stable elementary particles, and another channel consists of three stable elementary particles), we obtain the exact two-channel unitarity relations (one channel consists of two stable elementary particles, and another channel consists of one stable elementary particle and one bound-state or resonant-state isobar). Using the above results, the dynamical singularities of the scattering amplitude with isobars are discussed. Results indicate that Peierls cut may have the dominant effects on the physical region of the scattering amplitudes. Author

N65-10831# Oak Ridge National Lab., Tenn.
MOSSBAUER STUDIES OF THE HYPERFINE STRUCTURE SPECTRA OF ^{57}Fe IN FeRh ALLOYS, α-Fe_2O_3 AND $FeNH_4(SO_4)_2 \cdot 12H_2O$
D. W. Forester (Ph.D. Thesis—Tenn. U.) Nov. 1964 105 p refs
(Contract W-7405-ENG-26)
(ORNL-3705)

In this study, the Mössbauer effect was used to investigate magnetic properties of ferromagnetic, antiferromagnetic, and paramagnetic materials. For the iron–rhodium studies, and the α-Fe_2O_3 studies, the effective magnetic-field model was used, and was found to give a good description of the measurements of magnetic hyperfine structure splittings of the gamma-ray transition energy. One of the most useful results of these studies has been the information obtained about the temperature dependence of the effective magnetic field in antiferromagnets. When the temperature variation of the hyperfine structure constant is known, measurements of the effective magnetic field can provide information about the temperature dependence of electronic spin in antiferromagnets. In ferric–ammonium–alum, the ratio of the nuclear precession time to the spin-spin relaxation time is orders of magnitude smaller than in iron metal or α-Fe_2O_3. Therefore, the effective magnetic-field model did not provide a good description of the magnetic hyperfine structure spectra in this material. D.S.G.

N65-10864# Princeton U., N.J. Elementary Particles Lab.
A STUDY OF DI-PION RESONANCES PRODUCED AT LOW MOMENTUM TRANSFER IN $\pi^- + p \rightarrow \pi^- + \pi^+ + n$ AT 1.6 BEV/c
Alan R. Clark (Ph.D. Thesis) Aug. 1964 98 p refs
(Contract Nonr-1858(06))
(TR-35; AD-604581)

A system of spark-chamber spectrometers, with the ability to trigger selectively on the desired events, was used to investigate the di-pion mass spectrum between 450 and 1000 MeV. The di-pions were produced in the reaction $\pi^- + p \rightarrow \pi^- + \pi^+ + n$ at an incident pion momentum of 1.6 BeV/c. The mass resolution ($\pm$4 MeV) and statistics (> 6000 events) permitted the investigation of the spectrum in some detail for structure. In view of the apparent peripheral nature of the single pion production mechanism, the apparatus was designed to select primarily di-pions produced in the forward direction. The geometry also restricted the data to events with a $\pi\pi$ scattering angle (defined in the di-pion rest frame) in the vicinity of 90 degrees. D.S.G.

N65-10929# Nihon U., Tokyo (Japan) Coll. of Science and Engineering
BOSON LEVELS AND COMPOSITE MODEL IN U(4) SYMMETRY
Shin-ya Furui, Susumu Furuichi, Mitsuo Imoto, Shin Ishida, Shoichiro Kawasaki et al [1964] 11 p refs Submitted for Publication
(NUP-64-14)

Following the extended Sakata model where the four fundamental ur-baryons are introduced, the approximate U(4) symmetry is assumed, and the mass splitting of bosons, which comes from the mass differences of ur-baryons in the model, is investigated. Several relations among masses of both known and unknown bosons are obtained. Author

N65-10938# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TRANSMISSION OF A CHARGED PARTICLE THROUGH AN ELECTRON-ION BEAM
N. L. Tsintsadze 27 Dec. 1963 11 p refs Transl. into ENGLISH from Tr. Inst. Fiz., Akad. Nauk Gruz. SSR (Tiflis), v. 7, 1960 p 193-199
(FTD-MT-63-152; AD-602560)

The passage of charged particles, moving with constant speed through an electron–ion beam along its axis is considered, and the losses of energy with the passage of the charged particle are determined. It is assumed that the beam possesses axial symmetry, that it is included in a cylindrical waveguide with ideal conducting walls, and that the electrons and ions can be mixed along the axis of the beam. Linearized equations are formed to describe the interactions of the charged particle with the beam, and after consideration of variables, the losses of energy during transmission of a charged particle are determined. G.G.

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N65-10005# California U., Berkeley Inst. of Engineering Research
THE APPLICATION OF LANGMUIR PROBE TECHNIQUES TO FLOWING IONIZED GASES
Clark L. Brundin 15 Jun. 1964 108 p refs
(Contract Nonr-222(45); Grant AF-AFOSR-538-64)
(AS-64-9; AD-603668)

A detailed theoretical and experimental investigation regarding the use of Langmuir probe techniques in a flowing partially ionized gas has been carried out. Both free molecule and stagnation point probes have been considered. The analysis is restricted to the determination of ion density from the saturated ion current, and the determination of electron temperature from the rate of change of electron current with probe potential. Only gas velocities much less than the mean thermal velocity of electrons are considered, and the stagnation point probe theory is further restricted to frozen supersonic flow, and to weakly ionized gases. Numerical results are presented for argon, along with the results of a series of experiments conducted in an arc-heated, supersonic low-density wind tunnel. The ion density can be measured accurately with a stagnation point probe, or with a plane free molecule probe surrounded by a guard ring. The electron temperature can be measured accurately with a guarded plane free molecule probe, or with a cylindrical free molecule probe aligned with the flow. Measurements made in flowing gases with other types of Langmuir probes are subject to certain consistent errors. Author

N65-10010# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATION OF PLASMA MOVEMENT IN A COAXIAL SOURCE
H. M. Kovalev 7 Feb. 1964 6 p refs Transl. into ENGLISH from Fiz. Plazmy i Probl. Upravlyavemykh Termoyader. Sintez (Kiev), 1963 p 228–231
(FTD-MT-64-30; AD-605913)

Although electrodynamic theory for a coaxial source indicates that the magnitude of injection speed of plasmoids depends on, among other factors, the length of the coaxial, experiments have shown that the speed of the plasmoids attainable in practice is only very slightly dependent on the length of the coaxial. The reason for this unexpected result was explored, and the results presented show that secondary coaxial breakdowns existed in the coaxial source used. These breakdowns occurred to the rear and usually in direct proximity to the accelerated plasmoids. Similar breakdowns are proposed to explain the absence of acceleration of plasmoids along the second half of the coaxial length, and also to explain the observed small maximum speed of plasmoids in the experiment. M.P.G.

N65-10022# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.
PLASMA PHYSICS LABORATORY PROGRESS REVIEW, FIRST SIX MONTHS 1964
J. E. Drummond et al Aug. 1964 43 p refs

The discovery of a linear relationship between the damping rate of plasma oscillations and the pressure of neutral gas, coupled with the observation that the extrapolated straight-line plot of damping rate vs pressure passes under the origin, is considered the most interesting result reported. Other studies include these: (1) possible excitation of ion waves in a plasma of hot electrons and cold ions by the passage of an ion stream through it; (2) extension of the finite amplitude helical instability theory to plasmas in solids; properties of plasmas in solids; microwave diagnostics; electron heatings; and theoretical and other activities. M.P.G.

N65-10028 European Organization for Nuclear Research, Geneva (Switzerland) Nuclear Physics Apparatus Div.
CONTRIBUTIONS TO THE THEORY OF THE BEAM GUIDE
E. Regenstreif 24 Sep. 1964 45 p ref
(CERN-64-41)

Because the beam guide offers interesting possibilities for practical applications, such as channeling pions over distances of a few hundred meters and collecting the muons from the pion decay in flight, problems associated with beam-guide theory are investigated. Differential equations of motion, orbit equations, properties of the orbits, extreme values and helical orbits, grazing rays, momentum acceptance, high-energy behavior of the beam guide, angular acceptance, and phase acceptance are considered. M.P.G.

N65-10067*# Pennsylvania State U., University Park Coll. of Engineering
WAVE INTERACTION AND DYNAMIC NONLINEAR PHENOMENA IN PLASMAS Engineering Proceedings
Sep. 1963 240 p refs Papers presented at a conf. at Penn. State U., 4–6 Feb. 1963; Sponsored by Ionosphere Res. Lab. and NASA
(Grant NsG-369)
(NASA-CR-59074; P-42) OTS Prices: HC $6.00/MF $1.50

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7. SOME INVESTIGATIONS OF INSTABILITIES IN ONE-DIMENSIONAL PLASMAS John Dawson (Princeton U.) p121–122 refs

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9. ON THE NONLINEAR THEORY OF MULTISTREAM ELECTRONIC DEVICES C. L. Dolph and R. J. Lomax (Mich. U.) p 125–137 refs (See N65-10070 01-25)

10. BEAM-PLASMA AMPLIFIER EXPERIMENTS P. Chorney (Microwave Assoc., Inc.) p 138–146 (See N65-10071 01-25)

11. EFFECT OF NONUNIFORM PLASMA DENSITY ON ELECTRON BEAM-PLASMA INTERACTION G. A. Swartz and L. S. Napoli (RCA) p 147–156 refs (See N65-10072 01-25)

12. NONPLANAR PHENOMENA IN SINGLE AND MULTIPLE ELECTRON BEAMS T. G. Mihran (Gen. Elec. Co.) p 157–188 refs (See N65-10073 01-25)

13. MULTIDIMENSIONAL NONLINEAR THEORY OF MICROWAVE INTERACTION J. E. Rowe (Mich. U.) p 189–204 refs (See N65-10074 01-25)

14. ON THE NONLINEAR THEORY OF THE PLANE TRAVELING-WAVE TUBE S. Olving (Chalmers U. of Tech., Sweden) p 205–234 refs (See N65-10075 01-25)

N65-10068*# Pennsylvania State U., University Park Coll. of Engineering

ELECTROMAGNETIC NONLINEAR INTERACTION AND REFLECTION FROM A PLANE IONIZED MEDIUM

O. E. H. Rydbeck *In its* Wave Interaction and Dyn. Nonlinear Phenomena in Plasmas Sep. 1963 p 3–41 refs (See N65-10067 01-25) OTS Prices: HC $6.00/MF $1.50

(Contract AF 19(604)-4563; NSF G-18983)

The reflection properties of an isotropic ionized medium in the presence of nonlinear effects produced in the medium by a separate, very powerful "pump" wave of angular frequency ω_p are investigated. It is shown, to the first order, that if a primary signal or probing wave of angular frequency ω_0 impinges on the disturbed ionized medium at some specified angle, waves of frequencies ω_0, $\omega_0 + \omega_p$, and $\omega_0 - \omega_p$ are returned from the layer. It is also shown that the sum and difference frequency waves may be very much enhanced by nonlinear or parametric resonances of the system. Four types of secondary waves (the sum and difference waves) are produced, two of which are associated with primary waves and two of which exhibit the properties of independent electromagnetic waves. To show how the secondary waves leave the interaction region, the theory is extended to the case of a slowly varying inhomogeneous medium. The results show that the smaller the primary partial reflection, the greater the nonlinear resonance reaction. It is suggested that these results be checked experimentally with ionospheric topsounders. M.P.G.

N65-10069*# Pennsylvania State U., University Park

WHISTLER MODE AND IONIZED STREAM INTERACTIONS

O. E. H. Rydbeck and J. Askne (Chalmers U. of Tech.) *In its* Wave Interaction and Dyn. Nonlinear Phenomena in Plasmas Sep. 1963 p 71–111 refs (See N65-10067 01-25) OTS Prices: HC $6.00/MF $1.50

(Contract AF 19(604)-4563; NSF G-18983)

The mode transformation by which the incoming fast cyclotron waves of the stream are totally or partially reflected as whistler modes is studied in detail. This occurs when the wave normal is parallel to the stream and the exospheric magnetic field. The interactions are studied for arbitrary values of θ, the angle between the wave normal and the static magnetic field, that is initially assumed to be parallel to the infinitely wide ionized stream. The light waves that can interact in the system when $\theta \neq 0$ are examined to determine their influence on backward whistler-mode generation. It is shown that the streaming medium itself can actually amplify the whistler mode, and that space-charge waves play no essential role in whistler emission. Wave-propagation properties of a moving magnetoionic medium are discussed, and the general case when the stream makes some angle θ_s with the magnetic field is briefly considered. M.P.G.

N65-10070*# Michigan U., Ann Arbor Electron Physics Lab.

ON THE NONLINEAR THEORY OF MULTISTREAM ELECTRONIC DEVICES

C. L. Dolph and R. J. Lomax *In* Pa. State U. Wave Interaction and Dyn. Nonlinear Phenomena in Plasma Sep. 1963 p 125–137 refs (See N65-10067 01-25) OTS Prices: HC $6.00/MF $1.50

The possibility of using the velocity distribution as an artifice to solve problems of multistream devices, such as the klystron, traveling-wave tube, and the backward-wave oscillator, is investigated. A transport theory, similar to the so-called spherical harmonic method of neutron transport theory, is presented in a form suitable for a wide variety of microwave and plasma devices. The expansions are in terms of Hermite functions, although the possibility of using the invariant imbedding method is suggested. To determine the usefulness of the Hermite expansion method, emphasis has been concentrated on the one-dimensional traveling-wave tube problem as determined by the transmission-line approximation used by Brillouin and on the Landau–Vlasov transport equation. Numerical results are not yet available. M.P.G.

N65-10071*# Microwave Associates, Inc., Burlington, Mass.

BEAM-PLASMA AMPLIFIER EXPERIMENTS

Paul Chorney *In* Pa. State U. Wave Interaction and Dyn. Nonlinear Phenomena in Plasmas Sep. 1963 p 138–146 (See N65-10067 01-25) OTS Prices: HC $6.00/MF $1.50

(Contract NObsr-81206)

Experimental work is described that is directed toward demonstrating the feasibility of using the beam-plasma interaction to amplify millimeter waves. Discharges with plasma frequencies near 60 000 Mc were generated by means of a dual hot-cathode Penning discharge at low pressures. The densities were measured by Langmuir probe techniques. Extensive amplification experiments performed at 10 680 Mc produced net gains as high as 25 dB and electronic gains as high as 60 dB. The original study vehicle was redesigned, and preliminary results show substantial net gains. Author

N65-10072*# Radio Corp. of America, Princeton, N.J. RCA Labs.

EFFECT OF NONUNIFORM PLASMA DENSITY ON ELECTRON BEAM-PLASMA INTERACTION

G. A. Swartz and L. S. Napoli *In* Pa. State U. Wave Interaction and Dyn. Nonlinear Phenomena in Plasmas Sep. 1963 p 147–156 refs (See N65-10067 01-25) OTS Prices: HC $6.00/MF $1.50

A 23-kMc microwave amplifier that utilizes the two-stream instability as a gain mechanism was constructed. The two-stream instability is generated by passing a 1400-V electron beam through a cesium plasma 3 cm long, with a density that can be varied in a range up to 10^{13} ions/cm^3. The plasma is generated by a Penning discharge. Microwave power is coupled on and off the beam with helices. The electronic gain shows a maximum at one or more measured plasma densities. The number of maxima depends on the magnetic field, percent ionization of the plasma, electron temperature of the plasma, and the input power level. The maximum electronic gain is 40 dB, and the net gain for the tube is 8 dB. A probe placed in the plasma 1.5 mm from the beam indicated an increase in the saturated ion current to the probe as the microwave power was increased above 1 MW. Author

N65-10073*# General Electric Co., Schenectady, N.Y. General Electric Research Lab.

NONPLANAR PHENOMENA IN SINGLE AND MULTIPLE ELECTRON BEAMS

Theodore G. Mihran *In* Pa. State U. Wave Interaction and Dyn. Nonlinear Phenomena in Plasmas Sep. 1963 p 157–188 refs (See N65-10067 01-25) OTS Prices: HC $6.00/MF $1.50

Attention is directed toward nonlinear phenomena that occur in one or more electron beams of finite radius drifting in a region free from external fields after receiving density or velocity modulation at an input plane. The one-dimensional single-beam bunching theory is reviewed, and its modification in the case of finite diameter beams at small signal levels is discussed. The need for a large-signal finite beam theory leads to the disk-electron model. In calculations, this model correctly predicts the phenomenon of harmonic growth, which subsequently was verified experimentally. Paschke and Olving have recently developed a closed-form analytic theory for this effect. New computer calculations are reported that point up a basic disagreement with the Paschke–Olving theory in that signal level is found to affect profoundly the functional dependence of harmonic current with distance. Author

N65-10074*# Michigan U., Ann Arbor

MULTIDIMENSIONAL NONLINEAR THEORY OF MICROWAVE INTERACTION

J. E. Rowe *In* Pa. State U. Wave Interaction and Dyn. Nonlinear Phenomena in Plasmas Sep. 1963 p 189–204 refs (See N65-10067 01-25) OTS Prices: HC $6.00/MF $1.50

The subject of nonlinear interactions between accelerated streams (ions and/or electrons) and electromagnetic waves is discussed in the framework of a Lagrangian analysis. One-, two-, and three-dimensional analyses are developed, including arbitrary magnetic fields as specified by ω_c/ω. The cold plasma approximation is generally used but can easily be removed. Digital computer solutions of the nonlinear equations yield information on the growth rate and phase of the electromagnetic wave, in addition to velocity, phase, and harmonic current values for the stream charges as functions of distance and of rf signal amplitude. The nonlinear equations can be solved in closed form in the framework of a hard-kernel bunch description of the stream charge. Author

N65-10075*# Chalmers U. of Tech., Goteborg (Sweden) Research Lab. of Electronics

ON THE NONLINEAR THEORY OF THE PLANE TRAVELING-WAVE TUBE

S. Olving *In* Pa. State U. Wave Interaction and Dyn. Nonlinear Phenomena in Plasma Sep. 1963 p 205–234 refs (See N65-10067 01-25) OTS Prices: HC $6.00/MF $1.50

An infinitely wide electron beam interacts with an infinitely wide homogeneous slow wave structure, whereby the difficulties associated with radial boundary conditions are avoided. The nonlinear wave equation is solved to third-order accuracy by the use of the method of successive approximations. The one-valued velocity assumption limits the analysis to the range well below the saturation level. Within this range, however, the results describe such effects as the dependence of fundamental frequency gain and output phase on drive power, and the production of the first two harmonics. By the use of suitable approximations the nonlinear, plane TWT equation can be written in a form very similar to the exact, nonlinear, plane klystron equation. Author

N65-10082# Joint Publications Research Service, Washington, D.C.

ON THE HIGH-FREQUENCY CONDUCTIVITY OF MAGNETOACTIVE PLASMA

Yu. B. Ivanov and A. A. Rukhadze *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 54–66 refs (See N65-10076 01-23) OTS: $6.00

An expression was obtained for high-frequency conductivity of a fully ionized magnetoactive plasma in a region of wavelengths below that of the electron gyroradius, ω_H. The absorption of such short-wave oscillations was investigated for frequencies multiple to ω_H. Author

N65-10083# Joint Publications Research Service, Washington, D.C.

ELECTROMAGNETIC WAVES IN A SEMI-BOUNDED PLASMA

Yu. A. Romanov *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 67–78 refs (See N65-10076 01-23) OTS: $6.00

The plasma energy spectrum of a semibounded plasma is examined by the method of a kinetic equation assuming mirror reflection of electrons from the boundary. The problem of excitation of surface plasma waves by slow electrons is examined. Author

N65-10084# Joint Publications Research Service, Washington, D.C.

THE KINETIC INSTABILITY OF A UNIFORM MAGNETOACTIVE PLASMA

A. A. Andronov, V. V. Zheleznyakov, and M. I. Petelin *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 79–93 refs (See N65-10076 01-23) OTS: $6.00

The kinetic instability of a uniform magnetoactive plasma whose momentum distribution function of the static magnetic field H_0 is $f = G \exp[-(p_\parallel - p_\parallel^0)^2/a_\parallel^{-2} - (P_\perp - P_\perp^0)^2/a_\perp^{-2}]$ is considered where $(p_\parallel)$ and $(p_\perp)$ are, respectively, the longitudinal and transverse components of momentum. The electromagnetic perturbations are due to plane waves propagating at arbitrary angles to the magnetic field H_0. The obtained instability criteria are assumed to have a simple quantum interpretation. An expression for the absorption coefficient of the electromagnetic waves near the first harmonic gyrofrequency at plasma equilibrium is given. Author

N65-10085# Joint Publications Research Service, Washington, D.C.
NON-LINEAR OSCILLATIONS OF TWO-COMPONENT PLASMA
N. P. Giorgadze and N. L. Tsintsadze *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 94–107 refs (See N65-10076 01-23) OTS: $6.00

Wave propagation along a constant magnetic field in a plasma is considered. By approximating the small nonlinearities, the amplitudes and frequencies of the harmonics due to the interaction of almost linear waves are found. Author

N65-10086# Joint Publications Research Service, Washington, D.C.
POLARIZATION OF ELECTROMAGNETIC WAVES IN AN ISOTROPIC NONUNIFORM MEDIUM
I. A. Biryulin *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 108–117 refs (See N65-10076 01-23) OTS: $6.00

The propagation of electromagnetic waves in an isotropic medium with random inhomogeneities was considered. It was shown that for anisometric nonuniformities, the medium is anisotropic for the regular field component; this anisotropy considerably affects the polarization of electromagnetic waves. Author

N65-10087# Joint Publications Research Service, Washington, D.C.
THE KINETIC THEORY OF SCATTERING OF ELECTROMAGNETIC WAVES IN A PLASMA
O. P. Pogutse *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 118–133 refs (See N65-10076 01-23) OTS: $6.00

The scattering of electromagnetic waves in a plasma is discussed with a kinetic equation for a "microscopic" distribution function as a basic. This paper explains the effect of allowing for the fluctuations of the electromagnetic fields, and also the effect of nonlocal connection between the field of the incident wave and the fluctuating current on the scattering of transverse waves. For the solution of this problem, a method was assumed on the basis of the use of a kinetic equation for an exact "microscopic" distribution function. This method allows for the space dispersion and permits the systematic calculation of the effect of fluctuations of the electromagnetic field. Formulas obtained by this method are used in discussions of the contribution of the fluctuations of electromagnetic fields to a scattering cross-section in an isotropic plasma, and of a model problem on light scattering by separate charges moving in a dielectric with a refractive index greater than one. D.E.W.

N65-10088# Joint Publications Research Service, Washington, D.C.
THE RADIATION OF A CHARGED PARTICLE MOVING IN A NONSTATIONARY NONUNIFORM MEDIUM
K. A. Barsukov and B. M. Bolotovskiy *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 134–146 refs (See N65-10076 01-23) OTS: $6.00

The radiation of a charged particle moving in a medium whose parameters are dependent upon the coordinates and time according to the traveling-wave law is considered. The spectrum and energy of the particle radiation are found. Author

N65-10098# Joint Publications Research Service, Washington, D.C.
WAVE TRANSFORMATION IN A NONEQUILIBRIUM PLASMA
Ts. D. Loladze and N. L. Tsintsadze *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 256–257 refs (See N65-10076 01-23) OTS: $6.00

Transmission of longitudinal waves into transverse waves at the plasma–vacuum interface is studied when a beam of charged particles is passed through the plasma with a directional velocity of motion that is parallel to the interface. The amplitude of the transverse wave radiated into vacuum increases sharply, due to an effect resembling the phenomenon of "critical opalescence." Author

N65-10099# Joint Publications Research Service, Washington, D.C.
SCATTERING OF ELECTROMAGNETIC WAVES ON FLUCTUATIONS IN A PLASMA WAVEGUIDE
I. P. Yakimenko *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 258–262 refs (See N65-10076 01-23) OTS: $6.00

The aim of the present study is to find the correlation functions for a fluctuating electric field in a plasma waveguide of finite radius, and the differential coefficient for scattering of electromagnetic waves on change density fluctuations. The problem has been solved for the case of symmetric E-waves. It is possible to isolate a particular class of waves in this manner to determine correlation functions; in solving the more complete problem (for example, of the thermal radiation of a plasma cylinder) it is necessary to consider the entire sum of nonsymmetric waves. Author

N65-10278# Pennsylvania State U., University Park Ionosphere Research Lab.
TECHNIQUES FOR TREATING FULLY IONIZED TWO-PARTICLE PLASMA EQUATIONS Scientific Report No. 209
R. E. Hartle 1 Jun. 1964 102 p refs
(Contract AF 19(628)-4014; NSF G-18983)
(AFCRL-64-548; AD-607196)

The purpose of this work is to develop analytical methods for treating the Boltzmann–Maxwell or associated continuum equations for fully ionized two-particle plasma equations and to demonstrate their uses through specific examples. The descriptive equations are treated exactly; that is, the usual linearization approximation is not made. A time series expansion method along with the method of partial summation is applied to the cold plasma equations. More specifically, the dependent variables are expanded in time power series, and the coefficients are determined as functionals of the initial functions. Partial summation is applied to groups of terms in each expansion. The result is written in a convenient form comparable to that obtained by others and from which some plasma properties are obtained. Both the time series method and the method of characteristics are applied to the Boltzmann–Maxwell system. Author

N65-10282# Mount Auburn Research Associates, Inc., Cambridge, Mass.
STUDY OF COUPLING OF MAGNETOHYDRODYNAMIC WAVES TO ACOUSTIC WAVES AT A PLASMA-NEUTRAL GAS BOUNDARY Final Report
S. L. Kahalas, L. W. Parker, and D. A. Mc Neill 19 Aug. 1964 101 p refs
(Contract AF 19(628)-2836)
(AFCRL-64-813; AD-607260)

The coupling between magnetohydrodynamic waves and acoustic and electromagnetic waves is considered at a sharp boundary between a plasma and a neutral gas, and the coupling between magnetohydrodynamic and plasma waves and acoustic waves is considered at a diffuse boundary. In the sharp

boundary problem, the incident wave vector is arbitrary in direction and the magnetic field vector is considered either in the plane of incidence or perpendicular to it. The ratios of the amplitudes and energy in the transmitted waves (electromagnetic or acoustic) to the corresponding amplitudes and energy in the incident waves (fast and slow magnetoacoustic, pure Alfvén mode) are determined. In the diffuse boundary problem, the coupled wave equations are presented for a partially ionized plasma of spatially varying composition, with collision terms, in the presence of a magnetic field. The coupling of longitudinal plasma waves to sound waves is considered in the absence of a magnetic field. Author

N65-10291# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DETERMINING THE AVERAGE SPEED AND CONCENTRATION OF PARTICLES OF A RAPID FLUX OF RAREFIED PLASMA
V. B. Cherenkov, O. Yu. Sevast'yanov, and Yu. M. Lukoyanov 1 Oct. 1964 11 p ref Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan. i Mashinostr. (Moscow), no. 2, 1964 p 25–29
(FTD-TT-64-947/1+2; AD-607311)

A method is presented for determining the average speed and concentration of the particles of a rapid flow of rarefied plasma and the force of action of this flux on a body placed in it. The average speed and concentration of the particles were equal, respectively, to 37 km/sec and $7.4 \cdot 10^{11}$ 1/cm^3. The measurements of the flux parameters are carried out indirectly at the time of the experiment. The method makes it possible to determine the average speed of the flux from unity to some hundreds of km/sec with a concentration of the particles of from 10^8 to 10^{15} 1/cm^3. The proposed method is based on the simultaneous measurement of the number of particles passing in a unit of time through a determined section and of the force of action of this number of particles on a body whose coefficient of frontal resistance is precisely known. Author

N65-10339# Princeton U., N.J. Plasma Physics Lab.
PARTICLE CONFINEMENT TIMES IN THE ROTATING PLASMA OF THE B-3 STELLARATOR
J. G. Gorman Aug. 1964 17 p refs
(Contract AT(30-1)-1238)
(MATT-296)

Highly ionized deuterium plasmas having temperatures of 5 eV and peak densities of 2×10^{13} cm^{-3} are rotated with velocities up to 1.5×10^6 cm/sec by means of a probe-imposed radial electric field. Above a minimum rotational velocity, the particle confinement time in plasmas having the same rotational velocity is found to be proportional to the square of the magnetic confining field. The results are compared with the "diffusive equilibrium" model of Yoshikawa, Harries, Sinclair, and Young. Author

N65-10341# Princeton U., N.J. Plasma Physics Lab.
PLASMA CONFINEMENT IN THE MODEL C STELLARATOR
S. Yoshikawa, K. M. Young, R. M. Sinclair, and W. L. Harries Jun. 1964 101 p refs
(Contract AT(30-1)-1238)
(MATT-282)

The confinement of the plasma in the Model C Stellarator has been studied as a function of various parameters. The loss seems to be proportional to the ohmic heating current density $j_\parallel$, when $j_\parallel$ is high. This agrees with the theory of the drift mode "universal" instability of Kadomtsev and Kuckes, which is caused by both $j_\parallel$ and the density gradient perpendicular to the main confining field, B. Even when $j_\parallel$ is small, a rapid plasma loss is still observed. The cause for this loss may be connected with an imperfect toroidal equilibrium due to the effects of finite resistivity and finite ion Larmor radius ρ_i. Author

N65-10376# University of Southern Calif., Los Angeles School of Engineering
INTERACTION OF MICROWAVES WITH AN INHOMOGENEOUS AND ANISOTROPIC PLASMA COLUMN
C. Yeh and W. V. T. Rusch May 1964 31 p refs
(Contract AF 19(604)-6195)
(USCEC-82-218; EE-38; AFCRL-64-480; AD-606976)

The problem of the interaction of microwaves with a radially inhomogeneous plasma column confined by an impressed axial static magnetic field is treated analytically. Extensive numerical results for the backscattering cross sections are presented for various interesting ranges of the parameters involved. It is found that the often-used homogeneous model for interpretation of experimental data can sometimes lead to ambiguous results. This ambiguity arises because of the interdependence of the average plasma frequency, the gyrofrequency, and the inhomogeneity of the plasma-density distribution. Further measurements are suggested in order to distinguish these effects. Author

N65-10379# Chalmers U. of Tech., Göteborg (Sweden) Research Lab. of Electronics
RESEARCH IN THE FIELD OF PROPAGATION OF HIGH POWER WAVES IN IONIZED MEDIA Research (Survey) Report No. 48
O. E. H. Rydbeck 1 Jul. 1964 121 p refs
(Contract AF 61(052)-451)
(US-42; AFCRL-64-670; AD-607091)

The investigations reported cover the development of a nonlinear magnetoionic theory, generation and radiation of mixed frequency waves in ionized media, artificial heating of the F-region of the ionosphere, scattering of electromagnetic waves by oscillating, anisotropic dielectric, and ionized media, ionized stream–whistler mode interactions (in the exosphere), and wave propagation properties of moving ionized media. Author

N65-10430# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
FIELDS OF A CURVED PLASMA LAYER EXCITED BY A SLOT Mathematical Note No. 321
G. Hasserjian and T. P. Higgins Sep. 1963 28 p refs
(DI-82-0296; AD-422360)

A conducting cylindrical surface, of large radius of curvature, covered by a uniform plasma layer and excited by a magnetic line source located on the conducting surface is considered. The plasma layer is treated as a dielectric medium having an index of refraction that may be complex and may have a magnitude less than unity. Standard geometrical optics approximations are presented, and approximate model solutions are then obtained for special cases. The analysis method may also be applied to scattering problems and should provide a better approximation to radio problems of reentry vehicles than the flat plasma-layer approximation. M.P.G.

N65-10438# Aerospace Corp., El Segundo, Calif. Plasma Research Lab.
RADIATION FROM A FULLY IONIZED GAS AT THE PLASMA FREQUENCY
E. C. Taylor 15 Oct. 1964 20 p refs
(Contract AF 04(695)-469)
(SSD-TDR-64-185; TDR-469(5220-20)-1; AD-451080)

Thermal radiation from a fully ionized gas near the plasma frequency is investigated theoretically with consideration given to boundary effects. It is shown that the emission spectrum is a relatively complicated function of frequency, temperature, density, and geometry, but that the absorption spectrum can be approximated by a simple function of the three parameters representing frequency, collisions, and geometry. The sensitivity of the absorption curve to these parameters is investigated, and the results are used to interpret recently measured infrared radiation from a theta pinch. Author

N65-10441# General Electric Co., Schenectady, N.Y. Advanced Technology Labs.
MILLIMETER WAVE GENERATION BY PLASMA Final Engineering Report
T. T. Naydan May 1964 73 p refs Prepared jointly with General Electric Co., Syracuse, N.Y.
(Contract NObsr-89507)
(AD-604088)

This study describes the generation of a radiating electromagnetic wave by the interaction of a velocity-modulated electron beam with a resonant plasma, and the coupling of this radiated energy directly into a waveguide or a coaxial line. A standard 9-Gc electron gun and a helix configuration were utilized to produce and feed the velocity-modulated beam into a magnetically compressed, resonant plasma generated in mercury vapor. The plasma pulse was initiated at or near the peak of the magnetic cycle and showed a substantial conversion. It was concluded that the fast wave conversion will work best at the higher frequencies since the interaction length will be shorter and has more probability of being achieved in a plasma. G.G.

N65-10493# Harry Diamond Labs., Washington, D.C.
PLASMA WAVES
E. L. Resler, Jr. and Fred T. Harris 30 Jun. 1964 32 p refs
(HDL-TR-1237; AD-603901)

The macroscopic theory for waves in a fully ionized gas is presented. A common treatment is given covering certain phenomena of current interest. The equations describing a plasma are derived and are shown to including many of the following phenomena: sound waves, plasma oscillations, acoustical damping, magnetoionic theory, Friedrichs' waves, and cold, collisionless plasma. Author

N65-10550# Princeton U., N.J. Plasma Physics Lab.
FINE STRUCTURE OF H α AND H β IN STRONG MAGNETIC FIELDS
P. C. Norem Jun. 1964 12 p
(Contract AT(30-1)-1238; NSF GP-579)
(MATT-286)

By methods essentially identical to those described in a previous work the magnetic fine structure of the lines H_α and H_β of neutral hydrogen has been determined for statistical population of the n=4 and n=3 levels. The results for both lines indicate a rapid approach to the Pashen Back limit. The lines are narrow and sharp, typically 0.05 Å wide in the higher field cases for a single polarization. The results have been expressed as percentages of the total light intensity of each transition. All wavelengths given are the vacuum values. Author

N65-10561 Aeronautical Research Council (Gt. Brit.)
SOME SIMPLE CALCULATIONS RELATING TO THE GENERATION OF AN R.F. PLASMA
E. G. Broadbent London, HMSO, 1964 23 p refs Supersedes RAE-TN-AERO-2889, ARC-24950
(ARC-CP-746; RAE-TN-AERO-2889; ARC-24950) HMSO: 4s 6d

A cylindrical plasma is considered to be heated by rf currents to a temperature of about 8000° K in argon at a pressure of 50×10^{-6} atm. An estimate is made of the skin depth and of the uniformity of the plasma in the central region both with and without an axial magnetic field. A skew solenoid is suggested to provide a magnetic field inclined to the axis of the plasma. Author

N65-10563 Aeronautical Research Council (Gt. Brit.)
TEMPERATURE MEASUREMENTS ON A PLASMA JET
A. Wells and R. H. Kennett (RAE) London, HMSO, 1964 49 p refs Supersedes RAE-TN-AERO-2945, ARC-25878
(ARC-CP-756; RAE-TN-AERO-2945; ARC-25878) HMSO: 10s

Temperature measurements have been performed using spectroscopic techniques on the plasma jet obtained from a water-stabilized arc with carbon electrodes. The jet spectrum in the visible region consisted primarily of band spectra of molecular CN and C_2 and the Stark-broadened atomic line spectra of hydrogen. Intensities in various parts of these spectra were measured, and temperatures were then deduced from unresolved rotation line intensities in the CN 0-1 band, from unresolved band intensities in the CN and C_2 systems, from total intensities in the hydrogen Hβ and Hγ lines, and from the stark-broadened line profiles of the Hβ and Hγ lines. Temperatures were also measured by the method of spectrum-line reversal on the C_2 1-0 band head. Author

N65-10565# Atomics International, Canoga Park, Calif.
RESEARCH ON PROPERTIES OF HIGH CURRENT, LOW FREQUENCY ELECTRODELESS DISCHARGES Annual Technical Summary Report
C. A. Guderjahn [1963] 39 p refs
(Contract AF 49(638)-1222)
(AFOSR-64-0999; AI-64-48; AD-603935)

Alternating current, low-pressure electrodeless discharges were excited in cesium, rubidium, potassium, and mercury vapors by magnetic induction. In each case the discharge tube was a toroid forming the secondary of an iron core transformer whose frequency range was 1 to 40 kc. The resistivities of the discharges were measured as a function of current density (1 to 30 A/cm^2) and pressure (1μ to 300μ). The discharges were diffusion controlled and strongly ionized with electron-charged particle interactions being the principal contribution to resistivity. Resistivities were of the order of 0.2 Ωcm. Author

N65-10572# European Nuclear Energy Agency, Paris (France)
INTERNATIONAL SYMPOSIUM ON MAGNETOHYDRODYNAMIC ELECTRICAL POWER GENERATION Technical Summary
John A. Satkowski (ONR, Washington) 15 Jul. 1964 22 p Symp. Held in Paris, 6–11 Jul. 1964
(AD-445954)

The symposium was divided into the following sessions: (1) "Physical Properties of the MHD Working Fluid (Combustion Gas)"; (2) "Physical Properties of the MHD Working Fluid (Closed-cycle)"; (3) "Study of Magnetohydrodynamic Flows and Power Conversion Processes"; (4) "Liquid Metal and Unconventional MHD Conversion and AC Power Generation"; (5) "Production of Magnetic Fields"; (6) "Problems of Materials"; (7) "Open Cycle Converters"; and (8) "Closed Cycle Converters." One of the main conclusions of the symposium was that MHD power generation, used in conjunction with the

conventional steam turboalternator plant, is the only promising method presently known by which the overall thermal efficiency of hydrocarbon-fuel-burning power stations can be substantially raised. P.V.E.

N65-10598# Princeton U., N.J. Plasma Physics Lab.
ELECTRON TEMPERATURE MEASUREMENTS WITH ATOMIC BEAMS
Harold P. Eubank Jun. 1964 29 p refs
(Contract AT(30-1)-1238)
(MATT-276)

Neutral atoms moving across a magnetically confined plasma are subject to ionization by the plasma electrons. If the ionization cross section and the plasma electron density are known, and if the electron distribution is Maxwellian in shape, the attenuation of a neutral atomic beam gives a determination of the plasma electron temperature. A beam of potassium atoms at 3 keV was employed to measure the electron temperature in the B-1 stellarator. Beam-determined temperatures agree with conductivity temperatures within ±20% over the range 2 eV to 10 eV. The technique is applicable within the temperature range 1 eV to 30 eV and makes available swift measurements of localized plasma temperatures. Author

N65-10621# European Atomic Energy Community, Brussels (Belgium)
KINETIC EQUATIONS FOR PLASMAS
P. P. J. M. Schram 1964 67 p refs Work Completed in Assoc. with the Institut für Plasmaphysik, Garching, W. Germany
(Contract 003-61-1 FUAD)
(EUR-1805.E) Available from the Belg. Am. Bank and Trust Co., N.Y., Account No. 22.186: 85 Belg. Fr.

A short review is given of the theory dealing with derivation of kinetic equations. The advantages of the procedure of Sandri based on the concept of multiple-time scales are expounded in the case of weakly coupled and long-range homogeneous systems. The influence of an external homogeneous magnetic field is discussed in great detail. Although collective effects are not taken into account, the collision integral converges. A new contribution to the collision integral is found. A general expression for the Fourier transform of the radial distribution function outside thermal equilibrium, $G(\vec{k})$, is found by several methods. The results for small k introduce limitations on the behavior of the velocity distribution for large velocities. Finally, a new derivation of the virial theorem is given. Author

N65-10651# Oak Ridge National Lab., Tenn. Thermonuclear Div.
STUDIES OF THE ION-CYCLOTRON RESONANCE INSTABILITY
G. K. Soper (Ph.D. Thesis–Tenn. U.) Oct. 1964 138 p refs
(Contract W-7405-ENG-26)
(ORNL-3696) OTS: $4.00

This is a theoretical study of a highly localized electrostatic cyclotron resonance instability that describes the resonant coupling between plasma oscillations and the particle rotation in a magnetic field. An up-to-date survey of the current research and its application in the thermonuclear machines is presented. New calculations of the finite-geometric aspects of the microinstability theory and of its stable–unstable operating regimes are discussed. G.G.

N65-10837*# Illinois U., Urbana Engineering Experiment Station
A CLASSIFICATION OF THE DISPERSION SURFACES IN A MAGNETO-IONIC MEDIUM AND A STUDY OF THE ASSOCIATED RADIATION PATTERNS Scientific Report No. 2
R. Mittra and G. L. Duff Oct. 1964 37 p refs
(Grant NsG-395)
(NASA-CR-59502) OTS Prices: HC $2.00/MF $0.50

This study begins by demonstrating the important role played by the dispersion surfaces in the determination of the far fields of an infinitesimal dipole in a lossless, cold magneto-ionic medium. The dispersion surfaces are then classified, according to their shapes, for different ranges of the plasma parameters. A comprehensive group of radiation patterns is then given, including far fields for each of the 14 classified ranges of the plasma parameters. Author

N65-10841# Lincoln Lab., Mass. Inst. of Tech., Lexington
MODE THEORY OF THE ACTIVE MAGNETOHYDRODYNAMIC WAVEGUIDE Technical Report No. 304
J. R. Cogdell 2 Jul. 1963 70 p
(Contract AF 19(628)-500)
(AFESD-TDR-63-577; AD-423408)

The viewpoint taken in the analysis is quite similar to the common one in electron-beam theory, in that the relevant equations, once linearized, are shown to imply a small-signal conservation theorem. This approach leads naturally to an investigation of the interaction between the waveguide modes and coupling circuits. Particular stress is placed on the use of the conservation theorem in the development of a linear theory. The theorem is presented in a number of forms and is used to prove the following: (1) a uniqueness theorem; (2) the stability of the modes; (3) an orthogonality condition; and (4) a variational principle. Each of these properties is related especially to mode coupling with either lumped or continuous circuits. When the fields of the waveguide modes are considered, it is shown that two types of modes can exist in the waveguide. Both types of modes are discussed in detail. The theory is then applied to the special case of circular geometry. The dispersion equation is derived, and its solutions are discussed in a variety of cases. The general behavior of the fields is also discussed, and mode patterns are plotted in representative cases. The impedance of a coil in the waveguide is calculated, and coupling between a waveguide mode and an artificial transmission line is also evaluated. The results of these calculations are compared with those obtained from the simpler, one-dimensional theory. Author

N65-10865# General Electric Co., King of Prussia, Pa. Space Sciences Lab.
INVESTIGATION OF NON-THERMAL IONIZATION FOR MHD ENERGY CONVERSION
B. Hoffman and F. H. Shair Wright-Patterson AFB, Ohio, AF Aero Propulsion Lab., Oct. 1963 199 p refs
(Contract AF 33(657)-8298)
(RTD-TDR-63-4071, Pt. I; AD-423909)

This report describes a theoretical and applied research program directed toward prolonging the lifetime of magnetohydrodynamic (MHD) energy converters by reducing the necessary operating temperatures to the range of 1000° to 2000° K. The process of interest is the use of the magnetically induced electric field in the MHD generator for electrical breakdown of appropriate working fluids. Work was directed toward the use of alkali metals for Rankine (vapor) cycles (although the results are applicable to Brayton cycles with certain nuclear reactors) and alkali-metal-seeded noble gases for studying the basic parameters of the breakdown. Author

N65-10876# General Motors Corp., Indianapolis, Ind. Allison Div.
MEASUREMENT OF FLUID PROPERTIES FOR MAGNETOPLASMADYNAMIC POWER GENERATORS Quarterly Technical Summary Report, 1 May–31 Jul. 1964
R. T. Schneider 17 Aug. 1964 32 p Its Eng. Dept. Rept.-3965
(Contract Nonr-4104(00); ARPA Order 420)
(QTSR-5; AD-604889)

The voltage-current curves for a magnetoplasmadynamic generator with continuous electrodes, or with segmented electrodes, were obtained, and the saturation effect of the power output was observed. The power output increased only slightly, and finally saturated above the magnetic field strength of 10000 gauss for both the continuous and the segmented electrode curves. Since all the observed voltage-current curves were straight lines, it was concluded that no appreciable magnetically induced ionization had taken place. G.G.

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N65-10043*# Ohio State U. Research Foundation, Columbus Antenna Lab.
INVESTIGATIONS OF MASERS UTILIZING CROSS-RELAXATION
M. H. Spring 15 Oct. 1963 77 p refs *Its* Rept.-1093-23
(Grant NsG-74-60)
(NASA-CR-59406) OTS Prices: HC $3.00/MF $0.75

The study of cross-relaxation effects in paramagnetic crystals is of great intrinsic interest to millimeter-wave maser technology because of the possibility of obtaining maser amplification at higher frequency than that of the pump source. The quantum mechanical calculation of cross-relaxation rates, the rate equation analysis of the maser, and the experimental measurement of cross-relaxation rates are presented. It was shown that in materials such as ruby or emerald, the cross-relaxation rate is not sufficiently strong to be practical to build a maser with its signal frequency much larger than its pump frequency. However, cross-relaxation processes can hinder or assist maser amplification in a given maser amplifier. Author

N65-10063# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ANTIREFLECTION COATING AND TEMPERATURE STABILIZATION OF SILICON PHOTOELECTRIC CELLS INTENDED FOR WORK UNDER CONDITIONS OF RADIANT HEAT TRANSFER
M. M. Koltun and A. P. Landsman *In its* Cosmic Res., Vol. 2, No. 4, 1964 11 Sep. 1964 p 193–201 refs (See N65-10051 01-30)

A two-layered coating that makes it possible to combine effective antireflection coating with a sharp improvement in the radiation characteristics of the receiving surfaces of silicon photoelements is proposed, and calculations are made for it. An increase in the short-circuit currents and efficiencies of the photoelements by 40% to 42% was obtained experimentally by antireflection coating, with a simultaneous drop in the coefficient ratio α_c/ϵ to 0.94 to 0.98, which signifies temperature stabilization of the photoelements at the 44° to 45° level in operation aboard automatic interplanetary stations. Author

N65-10093# Joint Publications Research Service, Washington, D.C.
DIELECTRIC LAMINATED COATINGS WITH A LARGE REFLECTION COEFFICIENT
A. A. Vorob'ev, L. N. Bezmaternikh, A. N. Didenko, A. I. Lisitsyn, and A. P. Ol'shanskiy *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 204–211 refs (See N65-10076 01-23) OTS: $6.00

The reflecting properties of multilayer dielectric coatings based on the calculation of the reflection coefficient from a semi-infinite periodic medium are considered. It was shown that within the passband limits, a frequency exists for which the tangential electric field on the surface of the laminated medium vanishes. This permits the metallic walls of the resonators to be replaced by multilayer dielectric ones without field distortion in the resonance space in a number of cases. The results of experimental investigation verifying the possibility of constructing such resonators in the super-high-frequency range are given. Author

N65-10097# Joint Publications Research Service, Washington, D.C.
ON THE MATERIAL EQUATIONS IN THE ELECTRODYNAMICS OF PERIODICALLY NONSTATIONARY MEDIA
R. V. Karapetyan *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 252–255 refs (See N65-10076 01-23) OTS: $6.00

The conductivity of a periodically nonstationary crystal medium is considered. Such a nonstationary condition is produced when a stationary medium is acted on by an external strong periodic field, such as $E_{ext}(r,t)$ or $H_{ext}(r,t)$. The important special case in which the external strong field takes the form of a plane monochromatic wave is considered, and the properties of the tensor $\chi^{(n)}_{\alpha\beta}(\omega)$ in 11 of the various crystal classes are described. D.E.W.

N65-10128# Joint Publications Research Service, Washington, D.C.
STRUCTURE OF SURFACE LAYER OF GROUND PLATES OF SILICON AND GERMANIUM
T. P. Kapustina, T. G. Porokhova, and L. V. Tarnovskaya *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 9–18 refs (See N65-10126 01-14) OTS: $6.00

This paper presents a determination of the disrupted surface layer of semiconductor crystals of silicon and germanium that results from grinding with a free abrasive. Structure and methods of inspection are also considered. Author

N65-10249# Texas Instruments, Inc., Dallas
PRODUCTION ENGINEERING MEASURE TO INVESTIGATE PROPERTIES OF INDIUM ANTIMONIDE AND TO PROVIDE 801-C6 INFRARED DETECTORS Sixth Quarterly Progress Report, 27 Mar.–27 Jun. 1964
Robert L. Smythe and William L. Kolander Aug. 1964 25 p *Its* Rept.-6
(Contract DA-36-039-AMC-01463(E))
(TI-03-64-68; AD-606791)

The prescribed tests were performed on the preproduction detectors to prove their rugged character. Eleven of the twelve detectors withstood the destructive environments with only minor parameter changes. The eleven detectors' total performance remained wholly within all specifications. One detector received a cracked pin during a dimensional measurement, with resulting loss of vacuum. The vacuum loss is not attributable to environmental fatigue. No major difficulties were encountered during the testing. Minor problems were an amplifier power supply malfunction, liquid nitrogen feed-line

freezing, and required isolation (above ground) of operating test radiation sources. No major consequences resulted from any of these occurrences. All electrical parameters met or exceeded specification requirements as stated in SCS-150A dated 5 October 1962. Author

N65-10250# General Electric Co., Irmo, S.C.
SOLID ELECTROLYTE TANTALUM FOIL CAPACITOR Quarterly Research and Development Report, 29 Jun.–28 Sep. 1964
A. L. Jenny [1964] 38 p
(Contract NObsr-89380)
(AD-607061)

Efforts have continued toward obtaining anode material capable of higher formation voltages with the same or lower leakage current than previously obtained. Studies on both etched and plain foil have been conducted to determine needed annealing conditions and to study the effects of etch on leakage current and oxide breakdown potential. A new formation electrolyte was developed to enable attainment of higher anodization levels on both plain and etched foil. The effect of processing variables on the electrical properties of the prototypes is evaluated. D.S.G.

N65-10254# Massachusetts Inst. of Tech., Cambridge Crystal Physics Lab.
INVESTIGATION OF CRYSTAL GROWTH OF PURE AND DOPED METAL OXIDES Final Scientific Report, Jun. 1–Nov. 30, 1963
E. F. Farrell and A. Linz 1 Sep. 1964 13 p refs *Its* Tech. Rept.-4
(Contract AF 19(628)-2971)
(AFCRL-64-724; AD-607621)

The purpose was to investigate the growth and some physical properties of spinel crystals as a function of stoichiometry. Both pure and Cr^{3+} doped spinels were studied. Since there were considerable problems associated with the growth and chemical analysis of these crystals, this research was restricted to determining growth conditions and analytical methods. Author

N65-10259# Utah U., Salt Lake City
THE EFFECTS OF SURFACE CONDITION AND CHEMICAL ENVIRONMENT ON THE DEFORMATION AND FRACTURE PROCESSES OF CERAMIC MATERIALS Technical Documentary Report, 1 Dec. 1962–31 May 1964
O. W. Johnson and P. Gibbs Wright-Patterson AFB, Ohio, AF Mater. Lab., Aug. 1964 40 p refs
(Contract AF 33(657)-10398)
(ML-TDR-64-186; AD-606980)

Results obtained in study of high temperature deformation of rutile (TiO_2) are briefly summarized. Refined sample preparation techniques, which have resulted in a significant reduction in scatter of fracture strength data, are described. During surface damaging, atmospheres of O_2, N_2, and A have been found to have no detectable effect on subsequent fracture strength. Measurements of dislocation velocities in Ge crystals below 325° C are reported, at resolved shear stresses as high as 60 kg/mm^2. No drastic departures from known behavior at higher temperatures and lower stresses were observed. The diffusion of interstitial Li in rutile (TiO_2) was measured over a temperature range of 80° to 360° C, utilizing the optical absorption associated with the Li impurity as a measure of its concentration. Diffusion was found to be strongly anisotropic with diffusion coefficient D perpendicular to the c-axis smaller than D parallel by a factor of at least 10^8 up to 550° C. Author

N65-10264# Midwest Research Inst., Kansas City, Mo.
INVESTIGATION OF ELECTRO- AND MAGNETO-OPTIC TECHNIQUES FOR INFORMATION STORAGE AND RETRIEVAL Technical Documentary Report, 1 May 1963–31 Jul. 1964
R. A. Connell Wright-Patterson AFB, Ohio, AF Avionics Lab., Sep. 1964 67 p refs
(Contract AF 33(657)-11560)
(AL-TDR-64-228; AD-607220)

A program of research on materials for high-density information storage and retrieval has been conducted, with emphasis on the fabrication of thin films of MnBi. This intermetallic compound is ferromagnetic, with the axis of easy magnetization along its hexagonal c-axis. Several fabrication techniques were tried, including physical sputtering, grain-by-grain flash evaporation of both mixed powders and preformed alloy powder, and sequential evaporation schemes. The latter method has given the best results in spite of problems in interlayer diffusion and compound formation. X-ray diffraction studies of this process in a vacuum hot stage are discussed. A review of the state-of-the-art of electro-optic light modulators and their possible incorporation with Hackmanite-type phototropic memory planes was made. Author

N65-10266# Battelle Memorial Inst., Columbus, Ohio
STUDY OF SEMICONDUCTING PROPERTIES OF SELECTED RARE-EARTH METALS AND COMPOUNDS Final Technical Report
J. F. Miller, F. J. Reid, L. K. Matson, J. W. Moody, R. D. Baxter et al Wright-Patterson AFB, Ohio, AF Avionics Lab., 12 Oct. 1964 79 p refs
(Contract AF 33(657)-10687)
(AL-TDR-64-239; AD-607082)

This investigation was concerned with the compounding, crystal growth, characterization, and evaluation of compounds formed between the rare-earth elements and elements of chemical Groups V and VI. Special emphasis is placed on providing basic information to make possible the ultimate development of useful solid-state electronic devices based on these materials. In sampling the members of the rare-earth family, the elements cerium, neodymium, samarium, gadolinium, erbium, and ytterbium have been used in the preparation of representative compounds and alloys with anions, such as selenium, tellurium, oxygen, arsenic, antimony, phosphorus, and nitrogen. Single-crystal, bulk, and thin-film specimens have been prepared, and details regarding methods of compounding and crystal growth are given. Author

N65-10277# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
THE ROLE OF DIFFUSION CURRENT IN THE ELECTROLUMINESCENCE OF GaAs DIODES
M. F. Millea and L. W. Aukerman 8 Sep. 1964 10 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-174; TDR-269(4250-11)-5; AD-607451)

The intensity of the principal emission band of zinc-diffused GaAs p-n junctions with about 2×10^{17} electrons/cm^3 in the n-type region is proportional to $\exp(qV/kT)$. The energy of the peak of this band is independent of the forward bias V for these diodes. If the principal emission band results from the recombination of electrons that diffuse across the junction, and if nonradiative recombination is by far the more probable, then the intensity of the principal emission band is proportional to $\tau \exp(qV/kT)$, where τ is the minority carrier lifetime

in the p-type region. This dependence on τ comes, in part, from the gradient of acceptor concentration in the p-type region. Irradiation with 2-MeV electrons decreases the intensity and increases the forward current at a given voltage. Author

N65-10279# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
SPIN RELAXATION OF E' CENTERS: TEMPERATURE DEPENDENCE IN GeO_2 GLASS Scientific Report No. 2
J. G. Castle, Jr., D. W. Feldman, and J. Murphy Oct. 1964 14 p refs
(Contract AF 19(628)-3838)
(AFCRL-64-598; AD-607444)

Measurements of the spin relaxation time, τ, of E' centers in germania glass have been made at 3 kOe for temperatures from 1.2° to 25° K. An accurate fit to the data is obtained by the expression $1/\tau = A + BT + C/(e^{x_1} - 1)^{-1}$ where the same activation temperature of $x_1T = 11° \pm 2°$ K applies to both the samples tested. One sample had $A = 0$, $B = 0.6$ sec^{-1}° K^{-1}, and $C = 240$ sec^{-1}; the other, values about 1.5 times larger. An interpretation is discussed in terms of the local strain at the site of each E' center having a large value for phonon frequencies approximately equal to that of a localized mechanical resonance mode. Author

N65-10292# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
ELECTRON CONDUCTION PROPERTIES OF THIN FILMS OF MUSCOVITE MICA Semiannual Report, 1 Jul.–31 Dec. 1963
Malcom McColl 18 Sep. 1964 40 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-93; TDR-269(4250-12)-1; AD-607429)

Identification of the conduction mechanism through thin dielectric films as being Schottky emission of electrons from the cathode surface into polaron states in the conduction band of the insulator has been attempted. Voltage–current characteristics through a vacuum-cleaved crystalline-muscovite-mica film 1400Å thick, sandwiched between evaporated metal electrodes, were determined over a temperature range of 22° to 150° C, which was the limit of the experimental apparatus. The results are discussed and related in detail to previous relevant experimental work. Author

N65-10307# Istituto Universitario Navale, Naples (Italy)
ARTIFICIAL DIELECTRICS FOR MATCHING OR ABSORBING EM DEVICES
Gaetano Latmiral and Giorgio Franceschetti 20 Dec. 1963 55 p refs
(Contract AF 61(052)-589)
(SR-4; AD-603718)

In the study of cylindrical-obstacle or hole-type artificial dielectrics, the equivalent em parameters of these devices are theoretically computed and are experimentally checked. This must be considered as a first step for the study of em scattering from geometrically tapered layers. In the study of mixture-type lossless or lossy artificial dielectrics, the em parameters of these devices are measured in the microwave region, and reduced to several graphs. The above materials may be used for the construction of layered or geometrically tapered absorbing or matching sections. Author

N65-10318# Harry Diamond Labs., Washington, D.C.
THE CONTRIBUTION OF THE TWO-MAGNON PROCESS TO MAGNETOSTATIC MODE RELAXATION
Joseph Nemarich 10 Aug. 1964 28 p refs
(HDL-TR-1245; AD-603934)

The line widths of the magnetostatic modes have been measured at X-band with the static magnetic field along the [111] direction in several highly polished spheres of single-crystal pure yttrium iron garnet (YIG). The large variations of the magnetostatic mode line widths previously found in larger line widths at both 300° and 4.2° K, the variations being somewhat larger at 4.2° K. The essential features of the variation of mode line widths in a highly polished YIG sphere can be explained by the surface pit-scattering theory of Sparks, Loudon, and Kittel when the line width predicted by this theory is multiplied by an enhancement factor F_{nmr} to include the effect of the spatial variation of magnetization intensity for the individual magnetostatic modes. Author

N65-10327# Lincoln Lab, Mass. Inst. of Tech., Lexington
EXPLORATORY PREPARATION OF FOILS STRONGLY COLORED IN THE 1–16 μ REGION OF THE INFRARED Group Report, 1964-36
E. W. Pike 30 Jul. 1964 77 p refs
(Contract AF 19(628)-500)
(ESD-TDR-64-357; AD-604009)

This is a study of various materials that have strongly "colored" reflectivity, minimum absorption at all wavelengths, and a minimum weight per unit area of reflecting surface. Pure, smooth, copper films of 0.02μ thickness were formed by evaporation in a vacuum onto Mylar, and were dispersed by ultrasonic treatment into a foaming resin formulation and spread evenly in the 1μ septa of a connected foam. Satisfactory films could also be placed on a substrate by the vacuum evaporation of titanium disulfide. The detachment of free-standing flakes of fluorine-doped stannic oxide from the substrate of soluble glass, on which they had been formed, has been achieved. G.G.

N65-10334*# University of Southern Calif., Los Angeles
VACUUM ULTRAVIOLET RADIATION AND SOLID STATE PHYSICS Semiannual Status Reports No. 1, 2, and 3, Period Ending 28 Feb. 1963
G. L. Weissler 15 Mar. 1963 16 p
(Grant NsG-178-61)
(NASA-CR-59442) OTS Prices: HC $1.00/MF $0.50

Presented is an ultrahigh-vacuum system for reflectivity measurements on ultraclean evaporated films. An associated monochromator provides, beyond its exit slit, monochromatic radiation from the near infrared down to 1500 Å. Also described is an apparatus for observation of plasmon radiation excited in metal films that are bombarded by 50-kV electrons. A new vacuum monochromator is displayed that can be operated in two modes—as a Seya monochromator and as a grating incidence spectrograph. It will be used for light-source-development work, in order to develop new types of detectors capable of counting absolute numbers of photons leaving the exit slit, and to look for vacuum ultraviolet polarization effects. The last instrument described is a Vodar designed grazing incidence monochromator that covers the wavelength region from 1000 Å to 100 Å. The characteristic feature of this instrument is that in the scanning process the exit slit remains fixed, while both the grating and the primary slit (to which the light source is attached) move along straight lines. The instrument is useful for studying reflectivities of surfaces in the extreme ultraviolet, and the transmission properties of thin films, and in determining photoelectric yields from various surfaces. R.L.K.

N65-10345# Georgia Inst. of Tech., Atlanta Engineering Experiment Station

RESEARCH ON VACUUM EVAPORATED AND CATHODE SPUTTERED THIN FILMS Technical Report, 1 Jul. 1961–15 Feb. 1962

Richard B. Belser and William E. Woolf Wright-Patterson AFB, Ohio, AF Avionics Lab., Oct. 1963 123 p refs

(Contract AF 33(616)-6379)

(WADD-TR-60-381, Pt. III; AD-422916)

Diverse aspects of thin metal films have been studied, including the epitaxial growth of metal films deposited on single-crystal substrates by evaporation and by sputtering; the evaporation of alloys (InSb and brass); properties of films of the refractory metals deposited by sputtering; and a short survey of films of the rare-earth metals dysprosium and thulium deposited by evaporation. The conditions required for successful epitaxial growth of metal films on single-crystal substrates are peculiar to the metal-substrate pair. For noble metals, the conditions for parallel oriented growth appear restricted to limited substrate choices, substrate temperature ranges, deposition rates, heating methods, and other favorable conditions; more active metals, such as copper, nickel, and iron, can tolerate wider and less-controlled ranges of these same conditions. The apparatus and procedures used in these studies are described in detail. D.S.G.

N65-10350# Illinois U., Urbana Coordinated Science Lab.

ANOMALOUS CURRENT PEAKS IN THE I-V CHARACTERISTIC FOR TUNNELING BETWEEN TWO SUPERCONDUCTORS

M. G. Craford, R. N. Peacock, R. P. Ries, and C. B. Satterthwaite Aug. 1964 10 p refs

(Contract DA-28-043-AMC-00073(E))

(R-232; AD-604097)

From the results of tests of seven junctions that exhibited dc current peaks at voltages other than zero and of several others that did not, a number of tentative observations are made. The current-peak phenomenon may occur in structures that exhibit dc Josephson tunneling and also in structures with low critical-current superconducting shorts. There appears to be a tendency for the current peaks to occur periodically in voltage. The amplitude of the current peaks generally increases with decreasing temperature. In junctions where anomalous current peaks accompanied a dc Josphson effect, all the current peaks were sensitive to a magnetic field parallel to the junction surfaces. D.E.W.

N65-10355# Utah U., Salt Lake City Inst. for the Study of Rate Processes

MATTER UNDER ULTRA-HIGH PRESSURES AND TEMPERATURES Progress Report, 1 Oct. 1963–31 Mar. 1964

Henry Eyring and Terrell N. Andersen [1964] 4 p

(Contract DA-ARO(D)-31-124-G508)

(PR-5; AD-602523)

A new press with Bridgman anvils was completed and tested in order to make rapid electrical resistance measurements under pressure. Chamber parts for the belt apparatus were machined so that this device could be in operation immediately. Literature searches were started on several other related projects. D.E.W.

N65-10368# Chicago U., Ill. Enrico Fermi Inst. for Nuclear Studies

MAGNETIC SUSCEPTIBILITY AND PARAMAGNETIC RESONANCE ABSORPTION OF SALTS OF URANIUM AND TRANS-URANIUM ELEMENTS, SOLUTIONS OF ALKALI METALS IN LIQUID AMMONIA AND OF VARIOUS OTHER SYSTEMS Final Report

Clyde A. Hutchison, Jr. 2 Oct. 1963 118 p refs

(Contracts N6ori-02033; N6ori-02027; Nonr-2121(08))

(AD-421833)

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21. MAGNETIC SUSCEPTIBILITIES OF URANIUM (IV) AND PLUTONIUM (IV) IONS IN CUBIC FIELDS George A. Candela, Clyde A. Hutchison, Jr., and W. Burton Lewis 5 p refs

22. ERRATUM: MAGNETIC SUSCEPTIBILITIES OF URANIUM (IV) AND PLUTONIUM (IV) IONS IN CUBIC FIELDS George A. Candela, Clyde A. Hutchison, Jr., and W. Burton Lewis 1 p

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25. MAGNETIC SUSCEPTIBILITY OF NEPTUNIUM HEXAFLUORIDE IN URANIUM HEXAFLUORIDE Clyde A. Hutchison, Jr., Tung Tsang, and Bernard Weinstock 8 p refs

N65-10386# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A MILLION SUNS IN CRYSTAL
N. Yil'yin 1 Oct. 1964 8 p Transl. into ENGLISH from Sov. Patriot (USSR), 20 Mar. 1963 p 3
(FTD-TT-64-794/1; AD-607313)

This paper describes the mechanism of a ruby laser. The laser's possible application as a weapon in warfare—to destroy instantaneously the enemy's living forces, as well as his war potential of guided missiles, aerospace targets, tanks, surface vessels, and defense installations—is discussed. The utilization of the laser beam for a television system and in other communications media is also presented. G.G.

N65-10397# International Resistance Co., Philadelphia, Pa.
PRECISION VOLUME RESISTOR Interim Development Report No. 3, 1 Dec. 1963–29 Feb. 1964
M. Burk, C. Huang, and K. M. Merz 20 Mar. 1964 38 p
(Contract NObsr-89439)
(IDR-3; AD-606035)

Work was continued on the preparation of finely divided nickel powders for use in ceramic resistor systems. A study of the thermal decomposition of nickel formate in an autoclave at temperatures between 200° and 300° C was carried out. To date, the smallest average particle size attained is 0.4 μ. Preparation methods and some electrical properties of alumina–chromia–ceramic and vanadia–ceramic bodies have been investigated. In general, these systems have exhibited high voltage and temperature coefficients. Author

N65-10408# Harvard U., Cambridge, Mass. Cruft Lab.
ELECTRIC FIELD EFFECTS IN PARAMAGNETIC RESONANCE
E. B. Royce 12 Feb. 1963 157 p refs
(Contracts Nonr-186(16); Nonr-1866(28))
(TR-379; AD-401890)

The electric-field effects in paramagnetic resonance consist of shifts in resonance frequency produced by the application of a uniform electric field to the magnetic-resonance sample. These electric-field shifts arise through variations in the crystal-field splittings under the influence of the applied electric field. In a nonpiezoelectric sample, two mechanisms are considered to be important in producing the electric-field induced variation in crystal field. The optical mode ionic polarization of the crystal lattice, in which the anion and cation sublattices move with respect to each other, produces a variation in the local crystalline environment of the magnetic ion and, hence, in its crystal-field interaction; the electronic polarization of the magnetic ion alters its interaction with its crystalline surroundings, again producing a variation in the crystal-field interaction. Effects of electrostriction and piezoelectric distortion are mentioned but not treated in this work. Author

N65-10415# Stanford U., Calif. Solid-State Electronics Lab.
ELECTRON MICROPROBE STUDY OF LATTICE-POINT DEFECTS IN SEMICONDUCTOR SINGLE CRYSTALS Technical Report No. 5106–2
H. R. Potts Jul. 1964 99 p refs
(Grant DA-31-124-ARO(D)-155)
(SEL-64-075; AROD-2895-13; AD-450859)

Kossel-line, X-ray diffraction patterns generated from semiconductor crystals by an electron microprobe have been analyzed in terms of a lattice-point defect structure in the crystal. A method of lattice-constant measurement utilizing the Kossel-line technique was developed with an accuracy of ± 1 part in 10^4 and a precision of ± 2 parts in 10^5. Measurements of lattice constant were performed on germanium and gallium arsenide. Author

N65-10416# California U., Berkeley
DYNAMIC NUCLEAR POLARIZATION IN CRYSTALS Technical Report
C. D. Jeffries Aug. 1964 21 p refs Lecture Presented at a Discussion Meeting of the Roy. Soc., London, 21 May 1964
(Contract Nonr-222(61))
(TR-14; AD-604092)

A system of nuclear spins in coupling with electron spins in a solid is considered, as well as the possibility of appreciably polarizing the nuclear spins through excitation of the magnetic resonances of the system. In this variation of the dynamic polarization method, the nuclei are polarized directly by inducing certain forbidden microwave transitions. After a generalized description of these phenomena, details are given with applications to polarized proton targets. M.P.G.

N65-10464# Princeton U., N.J. Plastics Lab.
MOLECULAR STRUCTURE PARAMETERS IN CERTAIN SEMICONDUCTING POLYMERS
J. H. T. Kho and C. Cappas 15 Jun. 1963 44 p refs
(Contracts DA-31-124-ARO(D)-21; ONR-356-375)
(TR-67B; AD-411120)

The effects of the following variables on the electrical properties of the PAQR polymers were examined: hydrocarbon portion of the polymers, acidic portion of the polymers, copolymerization and mole ratio of starting monomers, metallic salt formation, and pressure and temperature. Correlations between structural parameters and macroscopic properties were established. Room-temperature resistivity was found to be indirectly dependent on the number of fused rings of monomer, ionization constant of acidic monomer, and square root of pressure applied, and to be directly dependent on the energy interval of all the PAQR polymers studied. Relations between number of fused rings of monomer and the following properties were also found—pressure coefficient of resistivity, energy interval, and resistivity at infinite temperature. Pressure coefficient of resistivity was found to be a direct function of the energy

interval of the polymers. Spin concentration varies directly with carrier concentration, and indirectly with room-temperature resistivity of the PAQR polymer. Author

N65-10471# Minnesota U., Minneapolis Physical Electronics Research Lab.
RESEARCH IN PHYSICS OF ELECTRON EMISSION AND ELECTRON TUBE TECHNOLOGY Second Interim Report, 16 Apr.–15 Oct. 1963
D. E. Anderson and W. T. Peria [1963] 346 p refs
(Contract AF 33(657)-10475)
(AD-423378) OTS: $5.00

This research report on the physics of electron emission and electron-tube technology covers the following subjects: "Basic Studies of Secondary Electron Emission"; "Studies of Practical Dynodes"—Al_2O_3 films, MgO films, and Fe_2O_3 strip multiplier; "Multilayer Thin-Film Tunnel Devices"—thin-film diodes and triodes, and the electron emission from thin-film diodes; "Studies of Thermionic Emitters"; "Influence of Absorbed Alkali on the Surface Properties of Semiconductors"; "Surface Cleaning Studies"; "Studies of the Alkali Antimonides"; "Studies of the Anomalous Photovoltaic Effect"; and "Electron Emission from Superconductors." G.G.

N65-10487# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE THEORY OF THE ATOMIZATION OF SINGLE CRYSTALS
Y. V. Martynenko 20 Oct. 1964 12 p refs Transl. into ENGLISH from Fiz. Tverd. Tela (Leningrad), v. 6, no. 7, 1964 p 2003–2009
(FTD-TT-64-949/1+2; AD-607855)

A formula has been obtained for the coefficient of atomization (spraying) of single crystals that does not have empirical coefficients. It was assumed that the potential of the interacting ions with the atoms of the target $U = A/r^2$. It is shown that with such a potential there should be screening of the lower atomic layers by the ones lying above, such screening being necessary for explaining the dependence of the coefficient of atomization on the angle-of-incidence of the ions. There is a computation of the average energy lost by the ion in each atomic layer. For obtaining the numerical value of the coefficient of the atomization it was assumed that the transmission of energy to the surface occurs with the aid of "focusons." The "g. ts. k." ("face-centered cubic") are discussed, and there have been taken into account only the "focusons" in the direction [110]. Author

N65-10523# Varian Associates, Palo Alto, Calif. Central Research Lab.
SOLID STATE MICROWAVE AND POWER DEVICES. VOLUME 2: MAGNESIUM GERMANIDE Final Technical Documentary Report
H. Kroemer, G. F. Day, R. D. Fairman, and J. Kinoshita Wright-Patterson AFB, Ohio, AF Avionics Lab., Oct. 1964 59 p refs
(Contract AF 33(657)-11015)
(AL-TDR-64-258, Vol. 2; AD-607985)

The objective of the magnesium germanide project described in this volume was to study the preparation and properties of the new semiconductor Mg_2Ge, in order to determine its feasibility and usefulness for electronic devices other than bipolar transistors, particularly for integrated electronics. A technique was developed for the preparation of high-quality single crystals of Mg_2Ge, with controlled dopings. It utilizes the reaction of stoichiometric amounts of the constituents in a graphite crucible, inside a hermetically sealed tantalum bomb, followed by the solidification of the molten compound into a single crystal by lowering the bomb through a temperature gradient (Bridgman technique). The details of a technique for the zone purification of commercial magnesium were worked out, using a sulphur dioxide atmosphere to eliminate magnesium evaporation. A technique was developed for the preparation of p-n junctions on n-type Mg_2Ge, utilizing the alloying to and diffusing into the Mg_2Ge of a thin evaporated gold film. Author

N65-10544# European Atomic Energy Community, Brussels (Belgium)
THE EFFECT OF LATTICE IMPERFECTIONS ON THE INTENSITIES DIFFRACTED BY NEARLY PERFECT CRYSTALS
R. Colella, A. Merlini, S. Pace, and E. van der Voort *In its* EURATOM'S Sci. Activities—Joint Nucl. Res. Center, Ispra Establ. 1964 15 p (See N65-10541 01-23) Available from the Belg. Am. Bank and Trust Co., N.Y., Account No. 22.186: 450 Belg. Fr.

The effect of thermal vibrations and small amounts of static imperfections on the intensities diffracted by nearly perfect crystals is examined with references to recent experimental work. Since the imaginary part of the atomic scattering factor is an important parameter in the formula for the intensities in anomalous transmission, a semiclassical method is outlined for the theoretical calculation of the parameter. Machine calculations of the photoelectric absorption coefficient μ and of the dependence of the imaginary part of the atomic scattering factor with the scattering angle were carried out for Si, Zn, and Ge, and for wavelengths from 0.1 to 2.5 Å. In qualitative agreement with experimental results, the angle dependence was found to be much smaller than that calculated by means of the classical formula of the damped, harmonic oscillator. The angle dependence is so small that a quantitative check of the theoretical data with absolute measurements of intensities is practically impossible. M.P.G.

N65-10545# European Atomic Energy Community, Brussels (Belgium)
PRODUCTION OF STEADY-STATE EXCESS CONDUCTIVITY DURING PLASTIC DEFORMATION OF ALKALI HALIDES
P. Camagni and A. Manara *In its* EURATOM'S Sci. Activities – Joint Nucl. Res. Center, Ispra Establ. 1964 10 p (See N65-10541 01-23) Available from the Bel. Am. Bank and Trust Co., N.Y., Account no. 22.186: 450 Belg. Fr.

A series of observations on the excess conductivity of alkali halides during homogeneous plastic flow at low and at constant rates are reported. The following points were confirmed: (1) When no electric field is applied, excess currents are not observed during compression. (2) The steady-state excess current during compression is proportional to the applied electric field. The dependence of $\Delta\sigma_s$ on mechanical parameters and on temperature was also investigated, as was the law governing the recovery $\Delta\sigma$ in the absence of creep defects. The results are considered indirect proof of bimolecular recovery. Several conductivity mechanisms are postulated, all of which fit some of the observed phenomena. M.P.G.

N65-10546# European Atomic Energy Community, Brussels (Belgium)
STUDY OF SOME LUMINESCENT EMISSIONS OF X-IRRADIATED ALKALI HALIDES
M. Boni and P. Camagni *In its* EURATOM'S Sci. Activities—Joint Nucl. Res. Center, Ispra Establ. 1964 10 p refs (See N65-10541 01-23) Available from the Belg. Am. Bank and Trust Co., N.Y., Account No. 22.186: 450 Belg. Fr.

Optical absorption studies to investigate the growth and the mutual relationships of color centers and impurity absorption centers during irradiation of X-ray colored crystals are reported, as well as radioluminescence studies of the nature and production of luminescent centers and their possible correlation with absorption centers. Results are reported for the behavior of the uv-emission spectrum of KCl and KBR at liquid-nitrogen temperatures and for the effects of thermal treatment. A scheme is proposed on the basis of these results, whereby the thallium responsible for the observed 310 and 345 mμ radioluminescence is in the form of a composite center of the molecule-ion type associated with a localized electronic defect. Its gradual formation during X-irradiation could proceed via the nucleation of simple hole-type centers around the impurity, assisted by the fact that the thallium of the matrix is an efficient electron trap. Luminescence should follow when one of the photoelectrons generated by X-rays is captured at the composite center, resulting in the destruction of the center by electron-hole recombination and energy release. Phosphorescent emission after irradiation could be due to residual centers losing their hole by some slow process, such as recombination with free electrons from shallow traps. M.P.G.

N65-10553# Kansas State U., Manhattan
SENSITIZED FLUORESCENCE Second Semiannual Technical Summary Report, 1 Jan.–30 Jun. 1963
Basil Curnutte, Jr. [1963] 16 p
(Contract Nonr-3634(02); ARPA Order 306-62; Proj. Defender)
(AD-604691)

Progress in the measurement of the total quenching cross section of thallium on mercury fluorescence is described. Preliminary results of an experimental determination of the total quenching cross section are given, and an analysis of the data is presented. Author

N65-10554# California U., La Jolla
RESISTIVITY OF SOLID AND LIQUID SODIUM
Michael P. Greene and W. Kohn 4 Aug. 1964 38 p refs
(Contract Nonr-2216(11))
(TR-25; AD-604178)

This paper reports a theoretical study of the resistivity of solid and liquid sodium. It utilizes inelastic neutron-scattering data to obtain the required information about the dynamics of the ions. The electron–phonon interaction is characterized by phase-shifts ηl, two of which are used as adjustable parameters. Although the calculation is believed to incorporate accurately many body effects, Umklapp processes, time-dependent effects, etc., agreement with experiment is disappointing. The calculated resistivity exceeds the experimentally measured values by a factor of the order of 2 at low temperatures, and above the melting point there are again discrepancies of this order. Author

N65-10569*# General Electric Co., Irmo, S.C.
SOLID ELECTROLYTE TANTALUM FOIL CAPACITOR Quarterly Research and Development Report, 1 Jul.–27 Sep. 1963
A. L. Jenny [1963] 27 p ref
(Contract NObsr-89380)
(AD-423325)

Work on the development of 150- and 250-volt devices capable of full-voltage operation at 85° C is summarized. The work is divided into four tasks. The first task is concerned with obtaining and preparing the tantalum foil to be used. The second task is to develop etching techniques, materials, and processes to obtain the maximum capacitance at the required formation voltage. Formation of plain foil samples is the object of the third task. The fourth task is to study the system Ta_2O_5/MnO_x during the deposition of maganese oxide, the reformation process, and the aging process. P.V.E.

N65-10589# South Dakota School of Mines and Tech., Rapid City
A GRAPHICAL REPRESENTATION OF GALVANOMAGNETIC THERMOMAGNETIC PHENOMENA
R. D. Redin 9 Sep. 1963 27 p refs
(Contract Nonr-2964(01))
(TR-9; AD-422669)

The definitions of the galvanomagnetic and thermomagnetic effects, their magnetic field dependence, and the relations between them are illustrated with diagrams. The diagrams show the relative orientations and magnitudes of the electric currents, heat currents, electrochemical potential gradient, and temperature gradient in a magnetic field and for conduction by electrons, holes, or both. For an isotropic material with conduction by both holes and electrons, 12 parameters are needed. Diagrams that show the variation of the Hall angle and electrical conductivity with the electron-to-hole carrier concentration ratio and that show the relations between the adiabatic and isothermal coefficients are included. Author

N65-10596# Atomics International, Canoga Park, Calif.
CRYSTALLOGRAPHIC EXPANSION OF BeO AT THE ALPHA-BETA BeO TRANSFORMATION TEMPERATURE
S. B. Austerman 15 Oct. 1964 11 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-9260) OTS: $0.50

A phase transformation has recently been demonstrated in BeO at about 2050° to 2100° C. Crystallographic expansion associated with this transformation has been measured by X-ray diffraction and by visual measurement with a traveling microscope. By the latter method, it was determined that expansion parallel to the c-axis was 5.9% ± 1.0%, and normal to the c-axis it was 0.0% ± 1.0%. By X-ray diffraction from single crystals, expansion was measured to be 6.1% ± 0.3% parallel to the c-axis, and −0.9% ± 0.3% normal to the c-axis. Author

N65-10624# Stanford Research Inst., Menlo Park, Calif. Poulter Labs.
ELECTRICAL EFFECTS OF SHOCK WAVES: CONDUCTIVITY IN CsI AND KI. THERMOELECTRIC MEASUREMENTS IN METALS Final Report
D. G. Doran and T. J. Ahrens 31 Aug. 1963 68 p refs
(Contract DA-04-200-ORD-1279)
(AD-423342)

Incidence of a 400 kb-shock wave in copper upon a constantan probe produces a peak emf of the order of 80 mV, compared with 14 mV calculated from zero-pressure thermopowers and theoretical shock temperatures. At 170 kb, measured peak emfs range from 23 to 90 mV, compared with 4 mV calculated similarly. The signals decrease by 50% during the first 0.1 μsec to 0.3 μsec, followed by a much less rapid decrease. Partial diffusion welding of the junction reduces the initial spike at 400 kb. Electrical resistivities of single-crystal NaCl, KI, and CsI have been measured at several shock pressures in the range 84 to 274 kb. The resistivity of NaCl is greater than 4×10^5 ohm-cm at 231 kb. The resistivity of KI is greater than 2×10^5 ohm-cm at 93 kb, but drops to less than 1 ohm-cm at 233 kb. The resistivity of CsI is greater than 6×10^5 ohm-cm at 215 kb, and less than 25 ohm-cm at 274 kb. Author

N65-10673# Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
THERMAL CONDUCTIVITY IN SOLIDS
Irving N. Greenberg May 1963 103 p refs
(USAELRDL-2361; AD-422664)

The present status of thermal conductivity in solids is reviewed. This report is concerned with the thermal conductivity in insulators (dielectric solids). It includes a discussion of theory from both the viewpoints of irreversible thermodynamics and quantum mechanics, and recent theoretical and experimental contributions. Author

N65-10674# Purdue U., Lafayette, Ind.
SEMICONDUCTOR RESEARCH Semiannual Report, Apr. 1–Sep. 30, 1963
H. Y. Fan et al [1963] 40 p refs
(Contract DA-31-124-ARO(D)-17)
(AD-423173)

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N65-10676*# General Electric Co., Philadelphia, Pa. Re-Entry Systems Dept.
MECHANICS OF DEFORMATION AND FRACTURE Final Report
I. J. Gruntfest and S. J. Becker Jul. 1964 107 p refs
(Contract NASw-708)
(NASA-CR-58971) OTS Prices: HC $4.00/MF $0.75

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3. COMBINED THERMAL AND GEOMETRIC EFFECTS IN VISCOUS MATERIALS I. J. Gruntfest 25 p refs (See N65-10679 01-26)

N65-10678*# General Electric Co., Philadelphia, Pa. Re-entry Systems Dept.
THERMAL EFFECTS IN MODEL VISCOELASTIC SOLIDS
I. J. Gruntfest and S. J. Becker *In its* Mech. of Deformation and Fracture Jul. 1964 30 p refs For presentation at the 26th Ann. Struct. and Mater. Conf., AIAA, Palm Springs, Calif., Apr. 1965 (See N65-10676 01-26) OTS Prices: HC $4.00/MF $0.75

As part of a general study of the behavior of materials with temperature-dependent properties, a simple model of a viscoelastic solid is considered here. Ideal experiments at constant stress and constant rate of deformation are examined. The analysis leads to yield and fracture criteria that in the usual theory are regarded as experimentally determined quantities. Rate of strain and size effects are also deduced, and a phenomenon resembling strain hardening can develop. The treatment is independent of, but complementary to, the atomic scale theories of the deformation of solids. The temperature coefficient of viscosity that is introduced into the continuum theory is related to the energy of activation for the flow process that is accessible to the atomic-scale theory. The consideration of the temperature field in which motions of the atoms occur could improve the predictions based on dislocation theory. Author

N65-10679*# General Electric Co., Philadelphia, Pa. Re-Entry Systems Dept.
COMBINED THERMAL AND GEOMETRIC EFFECTS IN VISCOUS MATERIALS
I. J. Gruntfest *In its* Mech. of Deformation and Fracture Jul. 1964 25 p refs (See N65-10676 01-26) OTS Prices: HC $4.00/MF $0.75

As part of a general study of the behavior of materials with temperature-dependent properties, combined thermal and geometric effects in ideal viscous materials are explored analytically. The responses of cylinders to constant axial loads and to constant rates of axial deformation are computed. This continuum analysis is independent of, but complementary to, the contemporary solid-state physics approach to the problem of the mechanical behavior of solids. The temperature coefficient of viscosity can be related to the atomic scale theory through the concept of the energy of activation for the flow process. Nonlinear feedback effects occur both as a result of heating, and of shape change. In the tensile case these are both destabilizing. In the compressive case the geometric effects are stabilizing and the heating effects are destabilizing. Author

N65-10684*# Cornell U., Ithaca, N.Y. Lab. of Atomic and Solid State Physics
RECENT INSTRUMENTATION FOR THE OPTICAL STUDIES OF SOLIDS IN THE VACUUM ULTRA-VIOLET
Paul. L. Hartman Jul. 1964 28 p refs
(Grant NsG-212)
(NASA-CR-59470) OTS Prices: HC $2.00/MF $0.50

Recent progress in vacuum ultraviolet instrumentation and techniques useful to solid-state physics is described. Improvements in sources, detectors, and dispersive systems (particularly in grating reflectivities) are noted. An important advance is noted in the use of laser radiation in conjunction with ultraviolet radiation in a double photon absorption process in KI. Author

N65-10703# Technische U., Berlin (W. Germany) Physikalisches Inst.
MEASUREMENT OF AMPLITUDE DISTRIBUTIONS OF VIBRATING AT-CUT CRYSTALS BY MEANS OF OPTICAL OBSERVATIONS
G. Sauerbrey *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 28–50 refs (See N65-10701 01-07)

Vibration patterns of the thickness-shear mode of AT-cut crystals were measured by an optical method. This method is based on the modulation of a small light beam by a vibrating boundary on the plate surface separating two areas of different reflectance. The modulation of the light flux is proportional to the amplitude of the mechanical vibration in the surface plane and is produced by that component of the plane vibration that is normal to the modulating boundary. Using two normally intersecting grids of boundaries, the two components are measurable all over the surface. The modulation was measured with a photomultiplier and a narrowband amplifier. The amplitude resolution is determined by the noise of the photoelectrons excited in the photomultiplier only and is better than $\Delta s = 10^{-8}$ cm. Author

N65-10704# Lowell Technological Inst. Research Foundation, Mass.
REACTIONS OF A VIBRATING PIEZOELECTRIC CRYSTAL PLATE TO EXTERNALLY APPLIED FORCES
C. R. Mingins, L. C. Barcus, and R. W. Perry *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 51–87 refs (See N65-10701 01-07)

The research on the reaction of vibrating quartz piezoids of circular form to compressional forces has been continued, and the investigation has been extended to consider the effects of forces that result in flexural distortion of the plate. Three types of bending arrangement have been used: (1) a clamped cantilever, (2) a cantilever with displaced knife edges, and (3) a dual support mounting with the deflecting force applied midway between. The curves obtained with (1) and (2) show generally one-half revolution in azimuth with negative frequency excursions and the other half with positive. With method (3) the two halves are indistinguishable. With (1) and (2), inverting the plate is equivalent to reversing the flexural force, and results in the reversal of the deviation sign. By varying the position of the intermediate force (at a knife edge), one can examine the transition from the dual support mounting to the cantilever. The results are different according to whether or not this knife edge is relieved at its center to avoid pressing on the most active portion of the plate. In the former case a saddle-shaped bend probably results—an astigmatic surface with curvatures of opposite sign. An analytical attack is proceeding concurrently via perturbation methods and nonlinear theory, introducing third-order elastic coefficients. Author

N65-10705# Clevite Corp., Palo Alto, Calif.
ENERGY TRAPPING AND RELATED STUDIES OF MULTIPLE ELECTRODE FILTER CRYSTALS
William Shockley, Daniel R. Curran, and Donald J. Koneval *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 88–126 refs (See N65-10701 01-07)

Energy trapping is proposed as an explanation for the behavior of high-frequency quartz filter crystals. Published elastic wave theory for lossless wafers includes a cutoff phenomenon. If the portion of the wafer surrounding the resonator has a cutoff frequency higher than the exciting frequency, the resulting vibratory energy is essentially confined to the resonator with an energy distribution decreasing exponentially with distance away from the resonator. This exponentiel decay is not associated with energy loss, but acts to trap the oscillating energy within a confined region. This energy trapping gives a basis for the high Q_m observed for crystals mounted on low Q supports and for the low interresonator coupling observed for multiresonator wafers. Measurements that support the energy trapping mechanism theory for exponential energy decay with distance have been obtained by varying interresonator spacing or distance from resonator to wafer edge. These findings are applicable to improved design for high-frequency filter crystals with both single and multiple electrode pairs. Author

N65-10707# Texas U., Austin
APPLICATION OF SUPERCONDUCTIVITY TO FREQUENCY CONTROL
William H. Hartwig *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 176–189 refs (See N65-10701 01-07)

The performance of superconductive tank circuits was investigated, and design criteria for a tunable superconductive frequency-control device are outlined. It is concluded that Q's in excess of 10^5 are readily obtainable using superconductive techniques. The dissipation mechanisms of superconductive tank circuits are delineated, and their relative importance is discussed. P.V.E.

N65-10708# Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
STATUS OF QUARTZ CRYSTAL RESEARCH AND DEVELOPMENT
G. K. Guttwein *In its* Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 190–214 refs (See N65-10701 01-07)

The present status, problem areas, and future trends in the field of quartz-crystal research and development are discussed. The discussion is divided into the following areas: frequency-control problems; oscillator crystals; filter crystals; nuclear-radiation effects; and crystal-research problems. P.V.E.

N65-10709# Hewlett-Packard Co., Palo Alto, Calif.
PRECISION CRYSTAL UNITS
Don Hammond, Charles Adams, and Len Cutler *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 215–232 refs (See N65-10701 01-07)

Information on the influence of temperature, bonding material variations in crystalline quartz, and geometry upon the frequency spectra and coupled modes is presented. The use of the X-ray topographic method in the identification of modes of motion is given. The data of the amplitude frequency effect and its response time are presented in relation to the nonlinearity of the elastic properties of quartz. Author

N65-10710# Paris Observatory, Meudon (France)
HIGH Q CRYSTAL UNITS
W. Ianouchevsky *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 233–247 refs (See N65-10701 01-07)

The quality factor is determined by the internal friction in the quartz. In case of plated crystals, the value of this factor is reduced by the damping due to the metal film deposited on the surface of the crystal. To decrease this damping, two conditions have to be fulfilled. First, the plated surface should be reduced to the minimum; and second, the most active part of the crystal must be kept free from plating. Three methods are available: excitation of the crystal by parallel field, leaving an unplated strip along the X-axis passing through the center; excitation by the normal field using annular electrodes, leaving the center area free from metal film; and excitation by a composed field—the combination of parallel and normal fields—the components giving a result along the Y-axis that increases the excitation and enables further reduction of the plating. The advantages and weak points of each type of excitation are discussed. Author

N65-10711# Bell Telephone Labs., Inc., Whippany, N.J.
USE OF PARALLEL-FIELD EXCITATION IN THE DESIGN OF QUARTZ CRYSTAL UNITS
A. W. Warner *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 248–266 refs (See N65-10701 01-07)

Attempts to improve the successful 2.5-mc and 5-mc high-precision quartz crystal units have resulted in a better understanding of the causes of frequency change with time. There appear to be two major causes of frequency change; relief of thermally induced stress at the gold quartz interface, and transfer of mass. The two effects are opposite in sign, and in successful crystal unit designs are very nearly balanced. Thus attempts to "clean up" the crystal by using higher temperatures and a better vacuum during fabrication will result in a less stable unit, since there will be more strain and less mass transfer. Parallel-field excitation has proven useful in removing the effects of temperature-induced stress and in reducing mass transfer. This not only makes possible improved frequency standards but also greatly extends the usefulness of resonant quartz as an analytical tool. Author

N65-10713# General Electric Co., Lynchburg, Va. Communication Products Dept.
DESIGN EQUATIONS FOR PLANO-CONVEX AT FILTER CRYSTALS
W. G. Stoddard *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 272–282 refs (See N65-10701 01-07)

A design equation for minimum motional inductance of planoconvex AT-cut crystals has been empirically derived. Minimum attainable inductance of planoconvex crystals is a function of contour radius of curvature, and can be accurately determined using this design equation. In addition, a design equation for predicting the resonant frequencies of low-order, thickness-shear modes in planoconvex crystals has been empirically derived. The location of thickness-shear inharmonics relative to the main response is also a function of contour radius of curvature. A brief description of application of digital computer techniques to filter crystal design is also presented. Author

N65-10717# Collins Radio Co., Cedar Rapids, Iowa
SPURIOUS MODES IN AT-CUT QUARTZ CRYSTALS
A. E. Anderson *In* Army Signal Res. and Develop. Agency and Lab. Proc. of The 17th Ann. Symp. on Freq. Control [1963] p 312–313 (See N65-10701 01-07)

Several methods of testing crystals for spurious modes, all with various advantages and disadvantages, are available. The method currently specified has the advantage of using standard crystal impedance meters. However, it has the disadvantage of being subject to operator error, of being too slow for high production rates, and of not having sufficient sensitivity to detect spurious resistances of much more than one and one-half times the resistance of the desired mode. A modification of this method increases the sensitivity by placing a resistor in parallel with the crystal under test. Another method uses the crystal as a frequency selector element between a sweep-frequency generator and an amplitude detector. It has sensitivity equivalent to the modified crystal-impedance-meter method, plus the capability of meeting high production rates. P.V.E.

N65-10724# Martin Co., Orlando, Fla.
EXCITATION OF MILLIMETER WAVE TRANSITIONS FOR FREQUENCY CONTROL
R. G. Strauch, R. E. Cupp, and J. J. Gallagher *In* Army Signal Res. and Develop. Agency and Lab. Proc. of the 17th Ann. Symp. on Freq. Control [1963] p 409–424 refs (See N65-10701 01-07)

Investigations that involve the utilization of millimeter transition for frequency-control purposes are discussed. Several practical problems, which must be overcome before theoretical limitations of such a transition can be investigated, are reviewed. It is concluded from the various experiments that a molecular-beam frequency standard, utilizing a millimeter transition, appears to be highly feasible. The ability of such a system to compete with other standards is dependent upon two major factors—the spectral purity of the excitation source, and the technique of applying the excitation to the molecular beam. P.V.E.

N65-10793# Tyco Labs., Inc., Waltham, Mass.
RESEARCH RELATING TO FUEL CELLS: PALLADIUM AND PALLADIUM-SILVER HYDROGEN DIFFUSION ELECTRODES Final and Summary Report, 1 Oct. 1962–30 Jun. 1964
A. C. Makrides 31 Jul. 1964 110 p refs
(Contract DA-49-186-ORD-982)
(AD-451499)

The concept of a solid-state diffusion electrode is described with particular reference to Pd and Pd-Ag alloys. Results of thermodynamic studies of Ag-Pd electrodes are presented, as well as time-potential curves obtained during the absorption of hydrogen from aqueous solution by Ag-Pd electrodes. The effect of silver on adsorption isotherms is established, and the results are discussed in terms of a model in which hydrogen is assumed to dissolve as protons, with the electrons occupying d-states in the conduction band. Experimental permeation and diffusion rates obtained with Pd and Pd-Ag membranes are presented. Electrochemical experiments at 30° C show that Pd-Ag membrane electrodes can sustain currents of about 30 mA/cm^2 if the surface reactions are catalyzed by palladization; at 200° to 250° C, a current density of 200 mA/cm^2 can be sustained at polarizations of 0.1 to 0.3 V. These rates are less than those expected for diffusion control; therefore, they are controlled by the kinetics of surface reactions. M.P.G.

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N65-10799# Joint Publications Research Service, Washington, D.C.
EFFECT OF THE STATE OF AGGREGATION OF DYES ON THE PHOTO-CURRENT CARRIER SIGN
A. N. Terenin, Ye. K. Putseyko, I. A. Akimov, and A. M. Meshkov 17 Nov. 1964 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 155, no. 4, 1964 p 900–903 (JPRS-27398; TT-64-51654) OTS: $1.00

The static condenser and the vibrating condenser were used for the determination of the signs of photocurrent carriers in dyes. Changes in the state of aggregation by the adsorption of polar gases and vapor on some dyes modified the absorbent spectra, the spectral distribution of the condenser photo, and the sign of the photocurrent carrier by reducing the dark and light conductivity of the mirror layers. G.G.

N65-10817*# Rensselaer Polytechnic Inst., Troy, N.Y.
RADIATION DAMAGE TO SEMICONDUCTORS BY HIGH-ENERGY ELECTRON AND PROTON RADIATION Progress Report, 15 Mar.–15 Sep. 1964
John C. Corelli [1964] 71 p refs
(Grant NsG-290)
(NASA-CR-59484) OTS Prices: HC $3.00/MF $0.75

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1. 15–45 MEV ELECTRON IRRADIATION OF GERMANIUM AT 300° K A. Kalma p 4–6
2. INFRARED STUDIES ON 36 AND 60 MEV ELECTRON-IRRADIATED (AT 320° K) SILICON AND GERMANIUM J. F. Becker p 7–9
3. CARRIER LIFETIME STUDIES ON GERMANIUM IRRADIATED AT 89° K BY 48 MEV ELECTRONS J. Fischer p 10–11
4. LOW TEMPERATURE (20° K) AND COLD TEMPERATURE (80° K) IRRADIATION AND ANNEALING OF 45 MEV ELECTRON-IRRADIATED SILICON AND GERMANIUM Li-Jen Cheng p 12–17
5. 1.5 MEV ELECTRON IRRADIATION (300° K) OF N-TYPE SILICON AND ANNEALING STUDIES TO 800° K O. H. Merrill p 18–20

N65-10910# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.
A STATISTICAL THEORY FOR AMORPHOUS STRUCTURES IN METALS
Charles M. Carlson Jul. 1963 58 p refs
(M-82-0269; AD-424521)

A simple quasi-lattice model is described for highly disordered structures in metals. The basis for the model is that a given number of atoms N occupy a number of sites N_t that are greater than N by a factor of 1.5 to 2.0. The different distinguishable ways in which the atoms can be arranged upon the sites lead to an entropy of disorder. The model is taken first as a crude approximation to the liquid near the melting point. A correspondence is established between the entropy of fusion of the liquid and the pre-exponential (D_o) factor in the equation for the coefficient of self-diffusion, derived via the theory of absolute reaction rates. Calculated entropies of fusion and D_o factors are compared with observed values. Application of the approach is then made to the concept of the disordered vacancy or relaxion hypothesized by Nachtrieb and Handler. Author

N65-10118*# General Dynamics/Astronautics, San Diego, Calif.
HYDROGEN-OXYGEN REACTION STUDIES First Quarterly Progress Report
Oct. 1964 9 p
(Contract NAS8-11405)
(NASA-CR-59415) OTS Prices: HC $1.00/MF $0.50

This is a description of a vacuum test chamber, developed and constructed for future studies of the nature and extent of the explosion and detonation hazards related to the venting of the hydrogen and oxygen propellants. G.G.

N65-10199# General Dynamics/Astronautics, San Diego, Calif.
TOXIC MATERIAL DIFFUSION PREDICTION FROM A 30% FLOX ATLAS SOURCE
3 Aug. 1964 21 p
(GD/A-DDB-64-017)

This is a study of the fluorine toxicity and the diffusion prediction in relation to the test and launch operations of an Atlas rocket launch, using 30% liquid fluorine and 70% liquid oxygen for the oxidizer. The causes of toxic propellants are discussed, and the toxicity limits for fluorine are shown and compared to other propellants. Atlas release modes are illustrated, and the exclusion distances are calculated. G.G.

N65-10226*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SATURN IB LIQUID HYDROGEN ORBITAL EXPERIMENT DEFINITION
F. B. Cline 12 Nov. 1964 131 p
(NASA-TM-X-53158) OTS Prices: HC $4.00/MF $1.00

The Liquid Hydrogen Orbital Experiment is planned to provide data on continuous orbital vent and settling as well as stage restart. The experiment justification, objectives, and S-IVB stage instrumentation are presented in detail. The experiment will be conducted in a 100-n. mi. circular orbit. The sequence of events for the experiment will be initiated by an onboard recorder or by ground commands. Two television cameras will be mounted in the manhole cover of the modified S-IVB stage of the Saturn 1B launch vehicle—SA-203. The cameras will observe the liquid-gas propellant interface during coast, orbit insertion, orbital maneuvers, and recirculation and thrust chamber chilldown prior to reignition. Nosecone instrumentation will provide data on acceleration acoustics, pressure, and temperature. P.V.E.

N65-10375*# Little (Arthur D.) Inc., Cambridge, Mass.
DESIGN ASPECTS OF EXPLOSIVE MIXTURES IN A VEHICLE INTERSTAGE Final Report
D. S. Allan, E. K. Bastress, J. M. Bonnaville, I. W. Dingwell, and A. E. Germeles 13 Jul. 1964 173 p refs
(Contract NAS8-5390)
(NASA-CR-59440) OTS Prices: HC $5.00/MF $1.25

Design techniques for the prevention and control of explosive mixtures of hydrogen and oxygen (or air) within a vehicle interstage during the period from propellant loading until stage separation are investigated. Limiting conditions for explosive reactions within the vehicle are established, and the

characteristics of explosions as they affect the structural integrity of the interstage are derived. The response of various typical structures to explosive forces is evaluated, and the critical periods in flight are determined. Principal control methods considered include aerodynamic and inert purging techniques, venting, compartmenting, and hardening of structural components. Because methods for elimination or control of explosions must necessarily be defined by the characteristics of the vehicle to which they are to be applied, recommendations as to specific techniques are left to the design engineer. M.P.G.

N65-10459# Stanford Research Inst., Menlo Park, Calif.
HIGH ENERGY OXIDIZERS IN SOLUTION Technical Progress Report No. 4 (Annual), Jul. 1, 1963–Jun. 30, 1964
W. E. Tolberg, R. S. Stringham, and M. E. Hill 31 Jul. 1964 30 p refs
(Contract AF 04(611)-9370; ARPA Order 24)
(RPL-TDR-64-125; AD-449382)

This report summarizes studies directed toward obtaining basic information on ions that may be formed when high-energy oxidizers are dissolved in liquid HF. It was found that an interaction product is formed from NF_3 and F_2 in liquid HF. From the mixture stoichiometry and from mass and NMR spectra, it appears possible that NF_4^+ may exist in HF solution. In addition, an unknown NF compound has been isolated from the HF solution. Preparation of pure HF having very low conductivity was accomplished, and methods for rigorous purification of oxidizer gases were developed. Author

N65-10511# British Internal Combustion Engine Research Assn., Slough (Gt. Brit.)
COMBUSTION IN DIESEL ENGINES Final Technical Report, 1 Aug. 1963–31 Jul. 1964
W. S. May and W. P. Mansfield 7 Sep. 1964 14 p
(Contract DA-91-591-EUC-2974)
(ATR-4; WR-2531; AD-605692)

The report describes the effect of low compression temperatures in diesel engines with various combustion systems and some attempts that have been made to improve combustion under these conditions. Two direct injection engines, one with a conventional (4-hole nozzle) combustion system and the other with an impingement (single hole nozzle) system, have been tested and their performance compared over a range of compression temperatures down to 525° C. The impingement system was found to give a controlled rate of pressure rise during combustion in spite of a long ignition delay. The effect of engine speed on combustion has been explored on the engine with the conventional injection system. The ignition delay was found to remain approximately constant in terms of time over the speed range (1250 to 1950 rpm). Author

N65-10515# Maremont Corp., Pasadena, Calif. Research and Development Labs.
STUDY OF ROCKET ENGINE EXHAUST PRODUCTS Twelfth Quarterly Report, 1 Mar.–31 May 1964
M. A. Greenbaum et al [1964] 23 p refs
(Contract AF 04(611)-7414)
(QR-7414-12; AD-605735)

Some of the thermodynamic properties of MgF_2(s), BF(g), BeOH(g), $Be(OH)_2$(g), AlF(g), AlF_2(g), AlCl(g), and F_2(g) were determined. Third law calculations as well as thermodynamic values reported at 298° K have been derived from the latest data reported in the JANAF tables. Thermodynamic data were obtained for the following: (1) vapor pressure, heat, and entropy of sublimation of MgF_2; (2) heat of formation and entropy of BF(g) from the reaction $BF_3(g) + 2B(s) \rightarrow 3BF(g)$; (3) heat of formation of BeOH(g) from the reaction $BeO(s) + 1/2H_2O(g) \rightarrow BeOH(g) + 1/4O_2(g)$; and (4) heat of formation of $Be(OH)_2$(g) from the reaction $BeO(s) + H_2O(g) \rightarrow Be(OH)_2(g)$. Author

N65-10797# Boeing Co., Seattle, Wash.
THEORETICAL PERFORMANCE OF LIQUID HYDROGEN WITH LIQUID OXYGEN AND NITROGEN OVER A WIDE RANGE OF MIXTURE RATIOS
Glen N. Peterson [1963] 177 p refs
(D2-20940; AD-444515)

Propellant performance calculations are presented for the equilibrium composition during expansion of several propellant combinations of liquid hydrogen and liquid oxygen–nitrogen mixtures at a chamber pressure of 500 psia, several area ratios, and various oxidizer–fuel ratios. The different performance parameters were calculated and tabulated. The optimum and vacuum specific impulses are presented graphically as functions of the propellant composition. G.G.

N65-10915# Aerojet-General Corp., Sacramento, Calif.
FEASIBILITY OF A TRIPROPELLANT FEED SYSTEM Monthly Contract Status Report, 1–31 Jul. 1964
C. M. Beighley et al 17 Aug. 1964 13 p
(Contract AF 04(611)-9571)
(M-8; AD-451208)

Propellant-development work has been completed, and operational tests of the propellant-feed system using liquid oxygen are continuing, prior to propellant-mixing tests. A few tasks still remain to complete the mixer–feed system installation, and 80% of the microengine hardware has been completed. Preparations are being made for cold-flow tests of the first gel mix. M.P.G.

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N65-10058# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
HYDROMAGNETIC AND THERMODYNAMIC PATTERN OF A MAGNETIC STORM
V. P. Shabanskiy *In its* Cosmic Res., Vol. 2, No. 4, 1964 11 Sep. 1964 p 137–153 refs (See N65-10051 01-30)

This article deals with the pattern of a magnetic storm. The shock wave that is propagated from the sun through the interplanetary gas (or by means of a solar corpuscular stream) intensively heats the interplanetary gas in the vicinity of the terrestrial magnetosphere. In this event the magnetosphere, subjected to the pressure of the corpuscular stream, heats up with considerably less intensity as a result of the existence within the sphere of a strong magnetic field. The virtual adiabatic compression of the magnetosphere during this period coincides with the first phase of the storm. With passage of time the magnetosphere is heated up by noncolliding magnetohydrodynamic waves that form at the boundary of the magnetosphere. As the effective temperatures are evened out in the magnetosphere and the stream, the magnetosphere experiences an expansion despite the fact that the pressure in the stream may not diminish. Author

N65-10256# ARO, Inc., Arnold Air Force Station, Tenn.
BASIC PROCESSES OF ION BEAM TERMINATION
J. D. Trolinger, J. F. Shipp, and A. E. Lennert Arnold Eng. Develop. Center, Aug. 1964 86 p refs
(Contract AF 40(600)-1000)
(AEDC-TDR-64-105; AD-603905)

Theoretical and empirical information necessary for the design of an electrical-propulsion test-facility, collector-system complex is compiled. Design considerations, which include sputtering, beam accommodation, secondary emission, and less serious secondary effects, are considered in some detail. A theoretical model is presented that accounts for the energy dependence of the sputtering phenomena first at low ion energies, and secondly in the region where the Bohr screening parameter is of the order of unity. Based on these functions obtained from the theoretical model in the two regions, an asymptotic empirical relation for the sputtering ratio as a function of ion energy is found to give a satisfactory account of available data. In addition, equations are developed to evaluate the effects of sputtered particles upon vacuum chamber pressure, the amount of flux leaving the target that returns to the engine, and the time required for the target to become saturated with beam particles. Two different collectors, the solid metallic type and a liquid metal system, are evaluated. The advantages and limitations of each are discussed. Author

N65-10568# Bristol Siddeley Engines, Ltd. (Gt. Brit.) Advanced Propulsion Research Group
HYPERSONIC RAMJET RESEARCH
R. Hawkins 8 Jun. 1964 23 p Paper Presented in Rome, 20 Jun. 1964

The most severe problems of airbreathing propulsion at hypersonic speeds facing the propulsion engineer are outlined, together with a review of the research directed toward their solution. Among the problem areas considered are these: (1) provision of structural material; and (2) dissociation of postcombustion products, and failure to recombine completely during expansion in the exhaust nozzle. M.P.G.

N65-10640* Israel Program for Scientific Translations, Ltd., Jerusalem
PROBLEMS OF FLIGHT BY JET PROPULSION: INTERPLANETARY FLIGHTS
F. A. Tsander and L. K. Korneev, ed. 1964 401 p 2d Edition Transl. into ENGLISH of the book "Problema Poleta pri Pomoshchi Reaktivnykh Apparatov: Mezhplanetnye Polety" Moscow, Gos. Nauchno-Tekhn. Izd. Oboroniz, 1961 Published for NASA and NSF
(NASA-TT-F-147; OTS-63-11195) OTS: $4.00

Questions of long-distance rocket flight, problems of interplanetary flight, and problems dealing with the preparations for such flights are discussed. Included are papers published for the first time: (1) "Design of the ER-1 Engine"; (2) "Flights to Other Planets (The Theory of Interplanetary Travel)"; (3) "The Use of Light Pressure for Flight in Interplanetary Space. Light Pressure on a Combination of Mirrors"; (4) "Calculations of Spaceship flight in the Earth's Atmosphere (gliding descent)"; (5) "Calculations of Spaceship Flight in the Earth's Atmosphere (ascent)"; (6) "Spaceship Temperature in Glide Landing on Earth"; and (7) "Deflection and Repulsion of Meteors by Electrostatic Charges Emitted by the Spaceship." P.V.E.

N65-10775*# Goodyear Aerospace Corp., Akron, Ohio
DESIGN AND FABRICATION OF AN INTERNALLY INSULATED FILAMENT WOUND LIQUID HYDROGEN PROPELLANT TANK
C. B. Shriver Washington, NASA, Nov. 1964 64 p
(Contract NAS3-2291)
(NASA-CR-127) OTS Prices: HC $1.75/MF $0.75

The design and fabrication of a small internally insulated filament-wound, fiberglass-reinforced plastic tank for liquid hydrogen use are presented. The tank consists of three main components: filament-wound fiberglass shell, insulation system, and an impermeable liner. The fiberglass shell is cylindrical with dome ends, 18 in. diam by 36 in. overall length, and has a design maximum test pressure of 100 psi. The shell consists of S/HTS 20 end glass roving in a matrix composed of an epoxy resin and a hardener. The insulation is located internally and consists of 4 lb/ft density polyurethane foam encapsulated in a vacuum-tight jacket of aluminum–Mylar–aluminum foil laminate. The impermeable liner consists of a similar laminate, and is located inside but not attached to the insulation. The tank weight, excluding a metal fill tube, is 12.25 lb. Some basic property data for some of the materials used in the tank are also presented. Author

N65-10844# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering
ANALYTICAL INVESTIGATION OF ROCKET ENGINE PERFORMANCE DEGRADATION DUE TO THE PRESENCE OF AN INERT DILUENT
Fredrik E. Anderson (M.S. Thesis) Jun. 1964 106 p refs
(GAM/ME/64-1; AD-604824)

The primary purpose was to determine the degradation of theoretical rocket engine performance that results from the introduction of nitrogen as an inert diluent into the oxidizer of the hydrogen–oxygen propellant combination. An additional objective was to outline an experimental program for exploration of the actual performance that can be attained of a rocket motor with such propellants. A program for computation of theoretical performance was written. Thermochemical equilibria of several exhaust gas species were expressed in terms of arbitrary equilibrium constants. The mass balance and equilibrium equations were linearized by a change of variable, and the simultaneous equations that resulted were solved by a matrix inversion technique. Isentropic expansion of the exhaust gas over a specific expansion area ratio was then calculated on the basis of frozen gas composition. Finally, the rocket performance parameters of characteristic velocity, thrust coefficient, and specific impulse were calculated. Theoretical performance was computed and analyzed for chamber pressures of 300 and 150 psia at a nozzle area ratio of 4.00:1 over a range of mixture ratios from 0.15 to 0.50 of stoichiometric for nitrogen fractions of 0, 0.20, 0.40, 0.60, and 0.75. Characteristic velocity for a nitrogen fraction of 0.75 indicated a degradation of 60% to 63% of the pure oxygen value at the same equivalence ratio. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N65-10017# National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.
COMPILATIONS OF SOLAR-GEOPHYSICAL DATA
Sep. 1964 40 p refs Abstracted from CRPL-F, Part B

This is a data collection from the NRL solar radiation monitoring satellite of the X-ray fluxes encountered in the bands of 0–8, 8–20, and 44–60 angstroms. The flux data were collected when the satellite was in range of a telemetry station. G.G.

N65-10077# Joint Publications Research Service, Washington, D.C.
THE DISTRIBUTION OF THERMAL AND NONTHERMAL RADIO EMISSION COMPONENTS IN THE GALACTIC PLANE
S. Ya. Braude and V. V. Vaysberg *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 1–11 refs (See N65-10076 01-23) OTS: $6.00

A possible model of the distribution source of thermal and nonthermal radio emission in the galactic plane is assumed. An analysis of the observed data is given in terms of this model. It was shown that the ratio of the densities of the indicated radio emission components in the direction of the galactic pole is one and one-half times less than in the direction of the center where $b^{II} = 20°$, and the average electron density over the plane is 0.2 el-cm^{-3}. Author

N65-10078# Joint Publications Research Service, Washington, D.C.
CONCERNING THE RADIATION SPECTRUM OF DISCRETE SOURCES IN CASSIOPEIA-A AND CYGNUS-A IN CENTIMETER AND DECIMETER BANDS
K. S. Stankevich *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 12–19 refs (See N65-10076 01-23) OTS: $6.00

As a result of precise measurements of Cassiopeia-A fluxes in centimeter and decimeter bands, the essential deviations of the spectrum from the simple law were discovered. The possible theoretical interpretations of these deviations are examined. It was shown that the radiation spectrum of the Cygnus-A source has a spectral index that smoothly increases with an increase in frequency, and is continuous. Author

N65-10079# Joint Publications Research Service, Washington, D.C.
THE THEORY OF RADIO EMISSION OF VENUS AND MARS
V. S. Troitskiy *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 20–29 refs (See N65-10076 01-23) OTS: $6.00

The phase dependence of the surface emission of Venus and Mars was considered, based on the assumption that a given periodic temperature regime of the surface exists. According to experimental data on the phase dependence of the emission of Venus and the radar data on the reflection coefficient, the rotation period of Venus was estimated as being approximately 2 to 10 days and revolving in a retrograde direction. Author

N65-10155# Liège U. (Belgium) Institut d'Astrophysique
INFRARED SPECTRA OF ASTRONOMICAL BODIES [LES SPECTRES INFRAROUGES DES ASTRES (REGION: 1μ À 3 mm)]
1964 534 p refs Proc. of the Twelfth Intern. Astrophys. Symp., Liège, 24–26 Jun. 1963; Sponsored by Liège U. and AF Cambridge Res. Labs.
(AFCRL-64-367; AD-602936)

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THE TELLURIC ABSORPTION SPECTRUM

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34. APPLICATION OF MULTIPLE BEAM INTERFEROMETRIC METHODS TO THE STUDY OF CO_2 EMISSION AT 15μ S. D. Smith and C. R. Pidgeon (Reading U., Gt. Brit.) p 336–349 refs (See N65-10178 01-13)

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36. NEW OBSERVATIONS OF ATMOSPHERIC EMISSION AND ABSORPTION IN THE 8–14 MICRON REGION James Westphal (Calif. Inst. of Tech.) p 357–361 refs (See N65-10180 01-13)

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37. INFRARED SPECTRA OF PLANETS AND COOL STARS: INTRODUCTORY REPORT G. P. Kuiper (Arizona U.) p 365–391 refs (See N65-10181 01-30)

38. MEASUREMENT OF WATER VAPOR IN THE ATMOSPHERES OF MARS AND VENUS A. Dollfus (Paris Obs.) p 392–395 (See N65-10182 01-30)

39. INTERPRETATION OF RECENT VENUS SPECTRA L. D. Kaplan (JPL) p 396 refs

40. THE WATER CONTENT OF VENUS INFERRED FROM HER MICROWAVE BRIGHTNESS D. Deirmendjian (RAND Corp.) p 397–405 refs (See N65-10183 01-30)

41. RECENT OBSERVATIONS OF INFRARED SPECTRA OF PLANETS (VENUS 1–4μ, MARS 1–4μ, JUPITER 1–1.6μ) V. I. Moroz (Sternberg Astron. Inst., USSR) p 406–419 refs (See N65-10184 01-30)

42. AN ANALYSIS OF THE SPECTRUM OF MARS L. D. Kaplan, G. Munch, and Hyron Spinrad (JPL) p 420–423 ref (See N65-10185 01-30)

43. OBSERVATIONS OF JUPITER AND THE GALILEAN SATELLITES AT 10 MICRONS B. C. Murray and R. L. Wildey (Calif. Inst. of Tech.) p 424

44. A PROGRAM OF STELLAR NARROW BAND INFRARED PHOTOMETRY P. E. Barnhart and W. H. Haynie (Perkins Obs.) p 425–431 (See N65-10186 01-29)

45. RESULTS OF AN INFRARED STELLAR MAPPING PROGRAM F. F. Hall, Jr. (ITT Federal Labs.) p 432–459 refs (See N65-10187 01-30)

46. TEN MICRON STELLAR PHOTOMETRY—FIRST RESULTS AND FUTURE PROSPECTS R. L. Wildey and B. C. Murray (Calif. Inst. of Tech.) p 460–468 refs (See N65-10188 01-29)

47. SOME PREDICTIONS FROM MODEL ATMOSPHERES REGARDING THE INFRARED SPECTRUM OF B STARS A. B. Underhill (Sterrewacht Sonnenborgh, Netherlands) p 469–475 refs (See N65-10189 01-29)

48. MODEL ATMOSPHERES FOR LATE TYPE STARS S. S. Kumar (Phys. Res. Lab., India) p 476–478 refs (See N65-10190 01-29)

49. MEDIUM DISPERSION SPECTRA OF TWO CARBON STARS AND ONE OXYGEN STAR IN THE 1 MICRON REGION A. A. Wyller (Oslo U.) p 479–496 refs (See N65-10191 01-29)

50. PROPOSED STUDIES OF LATE TYPE STARS K. Aa. Strand and S. Sharpless (Naval Obs.) p 497–500 refs (See N65-10192 01-30)

51. THE ASTROMETRIC DISCOVERY OF COMPANIONS OF VERY SMALL MASS P. van de Kamp (Swarthmore Coll.) p 501 refs

MISCELLANEOUS

52. THE ABSORPTION SPECTRUM OF INTERSTELLAR MATTER J. Borgman (Kapteyn Lab., Netherlands) and H. L. Johnson (Ariz. U.) p 505

53. INFRARED APPEARANCE OF DIFFERENT ZODIACAL CLOUD MODELS M. Harwit (Cornell U.) p 506–519 refs (See N65-10193 01-30)

54. OBSERVATIONS OF THE CRAB AND ORION NEBULAE IN THE REGION 1–2μ V. I. Moroz (Sternberg Astron. Inst., USSR) p 520–527 refs (See N65-10194 01-29)

55. A DAYTIME ACQUISITION SYSTEM FOR BALLOON ASTRONOMY J. Strong and M. Bottema (Johns Hopkins U.) p 528–532 refs (See N65-10195 01-14)

56. CONCLUDING REMARKS D. H. Menzel (Harvard Coll. Obs.) p 533–536

N65-10169# Sterrenwacht Sonnenborgh, Utrecht (Netherlands)
THE INFRARED SOLAR SPECTRUM; INTRODUCORY REPORT

C. De Jager *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 151–177 refs (See N65-10155 01-29)

This paper discusses present-day ideas on the structure of the solar atmosphere, the photosphere and its transition to the chromosphere and its continuous and line spectrum, the spectra of the chromosphere and the chromospheric faculae, the prominences and flares, and the corona. Author

N65-10170# Paris Observatory, Meudon (France)
SPECTROPHOTOMETRY OF THE HE 10.830 and H 10,938 (P γ) RAYS IN THE SOLAR CHROMOSPHERE [SPECTROPHOTOMETRI DES RAIES He 10.830 ET H 10.938 (P γ) DANS LA CHROMOSPHERE SOLAIRE]
Z. Mouradian *In* Liege U. Infrared Spectra of Astron. Bodies 1964 p 179–185 refs In FRENCH (See N65-10155 01-29)

Observations are reported of the P γ(10 938.09) rays and the infrared triplet of helium (10 829.08–10 830.25–10 830.34) during a study of chromospheric radiation at the edge of the disc. The spectrograph parameters, photographic techniques, and data-handling methods used are described. M.P.G.

N65-10171# Paris Observatory, Meudon (France)
STUDY OF RADIATION OF λ λ 3388–10747–10798 Å OF Fe XIII IN CORONAL CONDITIONS [ETUDES DES RAIES λλ 3388–10747–10798 Å DU Fe XIII DANS LES CONDITIONS CORONALES]
J. P. Dumont and J. C. Perche *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 186–210 refs In FRENCH (See N65-10155 01-29)

Supposing that the configuration of Fe XIII reduces to five energy levels, equations of the statistical equilibrium are solved giving the influence of the three following parameters: the dilution factor W, the electron temperature Te, and the electron density Ne. The study of the variation of the ratios I(10747)/I(10798) and I(10747)/I(3388) shows that these are more sensitive to Ne than to the other parameters for W70.15, corresponding approximately to a distance $< 6'$ and for $2.5 \times 10^7\,cm^{-3} \leq Ne \leq 10^9\,cm^{-3}$. Experimental values have been obtained for the ratio I(10747)/I(10798) at different points of the corona at a distance from the solar disc using a 20-stage photomultiplier. For a variation of 6° in the position angle, the ratio varies 3.58 ±0.35 to 2.13 ±0.3; each value is the average of six passages. Calculations for different models are in progress; at present, it seems that this method is spatially more selective than the method of determining the electronic density beginning with the corona K. Trans. by M.P.G.

N65-10172# Sterrenacht Sonnenborgh, Utrecht (Netherlands)
THE C-MULTIPLET NEAR 10.700 Å IN THE SOLAR SPECTRUM
C. de Jager and L. Neven (Observatoire Royale de Belgique, UCCLE) *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 213–234 refs (See N65-10155 01-29)

Measurements of the center-to-limb variation of the profiles of lines of the C-multiplet near 10700 Å in the solar spectrum have been obtained with high-dispersion spectrograph. The profiles were corrected for the influence of the apparatus. The central parts of the line profiles were studied with the Goldberg–Unno method and yielded a sightline microturbulent velocity component, increasing from 1.5 km/sec at $\tau_{5000} = 0.10$ to 2.3 km/sec at $\tau_{5000} = 0.05$. The lines show a small but distinct asymmetry, which is a function of the depth in the line profile. This asymmetry indicates the existence of convective motions. Convection stops at $\tau_{5000} \approx 0.06$; for increasing depths, the convective velocity component increases rapidly to more than 2 km/sec. Author

N65-10186# Perkins Observatory, Delaware, Ohio
A PROGRAM OF STELLAR NARROW BAND INFRARED PHOTOMETRY
P. E. Barnhart and W. H. Haynie (Eastman Kodak Co.) *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 425–431 (See N65-10155 01-29)
(Contract DA-30-069-ORD-3516; Proj. Defender)

Discussed is a program of stellar infrared measurements being undertaken for the purpose of determining the distribution of strong sources of infrared radiation arising outside the solar system. Also discussed is a stellar infrared photometer designed to operate simultaneously in two wavelength bands and to allow measurement in additional spectral bands by means of interchangeable narrowband interference filters. P.V.E.

N65-10188# California Inst. of Tech., Pasadena Div. of Geological Sciences
TEN MICRON STELLAR PHOTOMETRY–FIRST RESULTS AND FUTURE PROSPECTS
Robert L. Wildey and Bruce C. Murray *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 460–468 refs *Its* Contrib. No. 1187 (See N65-10155 01-29)
(Grants NsG 56-60; NSF G-25210)

The astrophysical significance of 10μ observations is extrapolated by making comparisons with model stellar atmospheres. Observations of nine stars (β Ori. α Lyr, α CMa, α CMi, α Per, α Aur, α Tau, α UMa, and β Gem) are presented, and for each a model atmosphere, obtained on the basis of its adopted surface gravity and effective temperature, is discussed. P.V.E.

N65-10189# Sterrewacht Sonnenborgh, Utrecht (Netherlands)
SOME PREDICTIONS FROM MODEL ATMOSPHERES REGARDING THE INFRARED SPECTRUM OF B STARS
Anne B. Underhill *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 469–475 refs (See N65-10155 01-29)

Interpretation of the equivalent widths, profiles, and displacements of the strong lines in B stars is discussed. The need for a reasonably detailed model of the relevant atmospheric layers, in order to interpret the equivalent widths of the stronger lines (excluding the hydrogen lines) in B-type stars, and to derive reliable abundances, is indicated. It is also indicated that in order to obtain models in radiative equilibrium, it is necessary to adopt temperature laws that give relatively low temperatures in the parts of the model between $\tau = 0.0$ and $\tau = 0.1$. From this it is concluded that lines from the second spectra of the metals may be expected to be formed in the outer parts of the atmosphere, and that lines from the OI and NI spectra may also be observed at middle and late B types. P.V.E.

N65-10190# Physical Research Lab., Ahmedabad (India)
MODEL ATMOSPHERES FOR LATE TYPE STARS
S. S. Kumar *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 476–478 refs Sponsored by NASA (See N65-10155 01-29)

Described is a procedure used for constructing model atmospheres for K- and M-type stars for the effective temperature range of 2500° to 4000° K and the surface gravi

range log g = 2 to 5. The initial (grey) model was constructed, using Mark–Lecaine expressions for the temperature distribution. The equation of hydrostatic equilibrium is solved in conjunction with ionization equations for hydrogen and an "average" metal and with the dissociation equation for molecular hydrogen. P.V.E.

N65-10191# Oslo U., Blindern (Norway) Inst. of Theoretical Astrophysics
MEDIUM DISPERSION SPECTRA OF TWO CARBON STARS AND ONE OXYGEN STAR IN THE I MICRON REGION
Arne A. Wyller *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 479–496 refs (See N65-10155 01-29)

Atomic line identifications of the spectral region λλ 9670 to 10 870 of 19 Piscium, Y CVn, and α Herculis are discussed, and a list of preliminary identifications is presented. As a result of the spectral-identification work, it is concluded that a full utilization of the spectral information inherent in the 1-micron region of the late-type stars hinges on at least two factors: (1) the need for a great amount of laboratory work to be done on the classification of the atomic lines in the region; and (2) the securing of IY spectra with improved resolution from that now available. P.V.E.

N65-10194# Sternberg Astronomical Inst., Moscow (USSR)
OBSERVATIONS OF THE CRAB AND ORION NEBULAE IN THE REGION 1-2μ
J. I. Moroz *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 520–527 refs (See N65-10155 01-29)

The fluxes from Crab nebula for three effective wavelengths in the region 1μ to 2μ were measured by means of the IR photoelectric photometer with the PbS photoconductive cell and Ge photovoltaic cell. This result gives some rough representation of the Crab nebula continuous spectrum in this region. The new observations are compared with measured flux in the λ < 1μ region and the radio observations. The appearance of the spectrum is in accordance with the hypothesis that supposes strong initial injection at the moment of Supernova explosion and following radiation loss without additional injection. The infrared brightness in the central part of the Orion nebula was measured by means of the same IR photometer. The observed brightness was interpreted as ordinary processes of the plasma thermal radiation. Author

N65-10567# Sacramento Peak Observatory, Sunspot, N. Mex.
STUDY OF MOTION AND EMISSION OF SOLAR PROMINENCES Solar Research Note No. 46
A. B. Severny and V. L. Khokhlova [1959] 40 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (Moscow), v. 10, 1953 p 9–53
(AD-423258)

Results are presented of measurements of motion and changes of brightness in prominences from movies obtained in H-alpha of hydrogen by means of a narrowband interference-polarization filter in 1948–1950 and for a short time in 1951. The discussion of results of measurements of motions makes it possible to divide all prominences into three classes (according to the type of motion predominant in them), and to give detailed characteristics of these classes and specific motions for them; to obtain some knowledge of the nature of observed motions in prominences (motions of electromagnetic and turbulent character); and to obtain knowledge of the spectra of turbulence in the solar atmosphere. Author

N65-10614# Air Force Systems Command, Kirtland AFB, N. Mex. Air Force Weapons Lab.
AN EXPERIMENTAL APPROACH TO THE SOLAR COSMIC RAY HAZARD
R. E. Linkous, J. F. Tinney, and B. C. Clark Aug. 1964 15 p refs
(RTD-TDR-63-3045; AD-444430)

An adequate understanding of the potential hazard requires the gathering of more data in the areas of flare occurrence; particle flare probabilities; type, intensity, rise times, decay times, energy spectrum, and direction of the particle flux; the interactions of high-energy charged particles with shielding materials; depth-dose patterns and linear-energy-transfer spectra for these radiations in man; and resultant biological effects. To obtain the volume of data required for the resolution of these unknowns, a scientific satellite experiment is proposed that, by operating between sentry and active modes, will be capable of collecting reliable and detailed measurements of solar corpuscular outbursts over a long period of time. Author

N65-10680*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GODDARD CONTRIBUTIONS TO THE 1963 JAIPUR CONFERENCE ON COSMIC RAYS
Mar. 1964 29 p refs

(NASA-TM-X-54748; X-611-64-63) OTS Prices: HC $2.00/MF $0.50

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2. MEASUREMENT OF PRIMARY COSMIC RAY CHARGE AND ENERGY SPECTRA DURING 1963 V. K. Balasubrahmanyan and F. B. McDonald 10 p refs (See N65-10682 01-29)

3. VELOCITY DEPENDENCE AND SOURCE SPECTRA OF SOLAR PROTON EVENTS D. A. Bryant, T. L. Cline, U. D. Desai, and F. B. McDonald 10 p refs (See N65-10683 01-29)

N65-10681*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MODULATION OF LOW ENERGY GALACTIC COSMIC RAYS
C. E. Fichtel, D. E. Guss, D. A. Kniffen, and K. A. Neelakantan *In its* Goddard Contrib. to the 1963 Jaipur Conf. on Cosmic Rays Mar. 1964 7 p refs (See N65-10680 01-29)

In order to study the variation of the galactic cosmic-ray proton and helium nuclei spectra, a series of balloon flights was made from Fort Churchill, Canada, beginning in 1961. This paper presents the results of the nuclear emulsion studies of the hydrogen and helium nuclei obtained in 1962 and 1963, and compares them to those obtained in 1961 and to the earlier results of many experimentalists from the period of increasing solar activity. D.S.G.

N65-10682*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MEASUREMENT OF PRIMARY COSMIC RAY CHARGE AND ENERGY SPECTRA DURING 1963
V. K. Balasubrahmanyan and F. B. Mc Donald *In its* Goddard Contrib. to the 1963 Jaipur Conf. on Cosmic Rays Mar. 1964 10 p refs (See N65-10680 01-29)

The differential energy spectra of H and He nuclei in the interval 100 to 800 MeV/ nuc, the integral H and He flux > 800 MeV/nuc, and the cosmic-ray charge spectra in the range

Z = 1– 8 have been measured, using a three-element telescope consisting of two thin scintillation counters and a Cerenkov counter. The measurements were made from Fort Churchill, Canada, on a Skyhook balloon flight during June, 1963. The ratio of Li + Be + B/C + N + O appears to be constant in the two regions 400 to 800 MeV/nuc and > 800 MeV/nuc. This ratio extrapolated to the top of the atmosphere is 0.28 ±0.08. A marked difference is observed in the form of the low-rigidity differential spectra of H and He. These measurements are compared with the results available from the last solar cycle.
Author

N65-10683*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VELOCITY DEPENDENCE AND SOURCE SPECTRA OF SOLAR PROTON EVENTS
D. A. Bryant, T. L. Cline, U. D. Desai, and F. B. Mc Donald *In its* Goddard Contrib. to the 1963 Jaipur Conf. on Cosmic Rays Mar. 1964 10 p refs (See N65-10680 01-29)

Solar particle events consisting of radiation with energy above 1 MeV are classified into four distinct classes. The distinction between the classes depends upon the way in which the particles are transported from the sun to the region of the earth. The first two classes consist of particles that arrive at the earth in a manner determined by particle velocity, direct transit, and diffusive propagation; the third class consists of those that arrive in a manner determined by motion of enhanced solar plasma; the fourth class consists of those that depend upon the rotation of the sun. Typical delays between the occurrence of a solar flare and the arrival at the earth of particles in these four classes are different. Several velocity-ordered events observed on Explorers XII and XIV are studied. It has been possible in these events to determine separately the influence of the propagation medium and the form of the energy spectrum of particles released from the sun.
D.S.G.

N65-10832# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Labs.
MEASUREMENTS OF ARTIFICIALLY INJECTED ELECTRONS FROM SATELLITE 1962 BETA KAPPA Final Report
R. V. Smith, W. L. Imhof, J. C. Bakke, J. B. Reagan, and J. H. Rowland Aug. 1963 32 p refs *Its* Rept.-3-05-63-1
(Contract AF 19(628)-2421)
(AFCRL-63-891; AD-423438)

Omnidirectional flux measurements have been carried out on a special Air Force satellite to establish the intensity, spatial extent, and spectral variations of fission electrons injected into trapped orbits in the earth's magnetic field from various high altitude nuclear detonations. Data are presented from the period 27 October to 21 November 1962. Omnidirectional electron fluxes above 1.2 MeV are given in the B-L coordinate system L = 1.18 to 1.70, and as a function of time also for L = 1.9 to 3.5. In addition, ratios of the outputs of two detectors with thresholds at 1 and 2 MeV are given vs L on 27 and 29 October, and vs time for L = 2.1, illustrating the spectral variations observed.
Author

N65-10911 Harvard U., Cambridge, Mass.
NATURAL IONOSPHERIC DIRECTIVITY AND MEASUREMENTS OF RADIO RADIATION IN SPACE
Michael Demetrius Papagiannis (Ph.D. Thesis) May 1964 321 p refs
(HSRP-108)

High levels of radio noise were observed on the night side of the earth, and the low levels were observed on the day side with steep changes in noise levels over the transition regions. Measurements of the total radio flux at 0.7 and 2.2 Mc were gained from the AP-3 high-altitude probe. A theory for the development of the Z-mode is presented that utilizes the full-wave theory for the cases of vertical incidence with oblique magnetic field, and the cases of oblique incidence with a vertical magnetic field, in order to compute the coupling coefficient. Also presented is a new method for the computation of the critical cone angle and the directivity patterns by the introduction of a mathematical formulation to Poeverlein's graphical solution for use in the process of ionospheric focusing.
G.G.

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N65-10051# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
COSMIC RESEARCH, VOLUME 2, NUMBER 4, 1964
11 Sep. 1964 246 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 2, no. 4, 1964 p 507–654
(FTD-TT-64-892/1+2; AD-605513)

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6. ANALYSIS OF THE CHEMICAL COMPOSITION OF A LAMINAR MULTICOMPONENT BOUNDARY LAYER ON THE SURFACES OF BURNING PLASTICS G. A. Tirskiy p 97–136 refs (See N65-10057 01-33)

7. HYDROMAGNETIC AND THERMODYNAMIC PATTERN OF A MAGNETIC STORM V. P. Shabanskiy p 137-153 refs (See N65-10058 01-28)

8. ON THE FINE STRUCTURE OF THE THERMAL-EMISSION SPECTRUM OF THE EARTH'S ATMOSPHERE K. Ya. Kondrat'yev and Yu. M. Timofeyev p 154–164 refs (See N65-10059 01-12)

9. SCATTERING OF LIGHT IN A SPHERICAL ATMOSPHERE. III I. N. Minin and V. V. Sobolev p 165-179 refs (See N65-10060 01-30)

10. THE DAYLIGHT LUMINESCENCE OF THE UPPER LAYERS OF THE TERRESTRIAL ATMOSPHERE IN THE 1.25μ REGION N. M. Gopshteyn and V. I. Kushpil' p 180-185 refs (See N65-10061 01-12)

11. EFFECT OF HIGH-ENERGY PROTONS ON SEMICONDUCTOR NUCLEAR-RADIATION DETECTORS L. S. Brykina, B. M. Golóvin, A. P. Landsman, B. P. Osipenko, and O.P. Fedoseyeva p 186–192 refs (See N65-10062 01-14)

12. ANTIREFLECTION COATING AND TEMPERATURE STABILIZATION OF SILICON PHOTOELECTRIC CELLS INTENDED FOR WORK UNDER CONDITIONS OF RADIANT HEAT TRANSFER M. M. Koltun and A. P. Landsman p 193–201 refs (See N65-10063 01-26)

13. INVESTIGATION OF RADIATION WITH THE FLIGHTS OF THE "MARS-1" AND "LUNA-4" INTERPLANETARY AUTOMATIC STATIONS S. N. Vernov, A. Ye. Chudakov, P. V. Vakulov, Ye. V. Gorchakov, Yu. I. Logachev et al p 202–216 refs (See N65-10064 01-30)

14. EFFECTIVENESS OF PHARMACOCHEMICAL PROTECTION IN GAMMA IRRADIATION AND IRRADIATION BY PROTONS WITH ENERGIES OF 660 AND 120 Mev V. S. Shashkov, P. P. Saksonov, V. V. Antipov, V. S. Morozov, G. F. Murin et al p 217–231 refs (See N65-10065 01-04)

15. OCCURRENCE OF CROSSING OVER IN DROSOPHILA MALES UNDER THE INFLUENCE OF VIBRATION, ACCELERATION AND γ-IRRADIATION G. P. Parfenov p 232–241 refs (See N65-10066 01-04)

N65-10052# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

APPROXIMATE CALCULATION OF TRAJECTORY FOR ENTRY INTO ATMOSPHERE

V. A. Yaroshevskiy *In its* Cosmic Res., Vol. 2, No. 4, 1964 11 Sep. 1964 p 1–36 refs (See N65-10051 01-30)

Certain assumptions characteristic of the basic segment of an atmosphere-entry trajectory are introduced, enabling the reduction of the equations of motion to a nonlinear second-order equation. This equation is then used to derive approximate analytical solutions for the flight trajectory, and to analyze the influence of the entry conditions and of the aerodynamic characteristics on such important parameters as maximum acceleration, maximum heat flow, etc. D.E.W.

N65-10053# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

TRACKS OF DIURNAL ARTIFICIAL EARTH SATELLITES

I. V. Aleksakhin, E. P. Kompaniyets, and A. A. Krasovskiy *In its* Cosmic Res., Vol. 2, No. 4, 1964 11 Sep. 1964 p 37–48 (See N65-10051 01-30)

Working formulas are derived for determining the tracks of diurnal artificial earth satellites. The parameters of the tracks are derived and determined as functions of the parameters of the powered segment of the rocket booster's trajectory. Author

N65-10054# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE POSSIBILITY OF IMPROVING THE ACCURACY OF DETERMINATION OF THE ORBITS OF SPACE VEHICLES BY REDUCING THE INFLUENCE OF CORRELATED ERRORS

A. V. Brykov *In its* Cosmic Res., Vol. 2, No. 4, 1964 11 Sep. 1964 p 49–70 refs (See N65-10051 01-30)

The article is devoted to the problem of using statistical methods for processing correlated measurements to determine the actual orbits of space vehicles when the probability characteristics of the measurements are either known or unknown. The basic relationships characterizing the effectiveness with which these methods can be applied are ascertained by a simple example in which two correlated measurements are reduced. Author

N65-10055# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

OPTIMUM REGIMES OF MOTION FOR A POINT OF VARIABLE MASS WITH LIMITED POWER IN UNIFORM CENTRAL FIELD

J. K. Isayev, V. V. Sonin, and B. Kh. Davidson *In its* Cosmic Res., Vol. 2, No. 4, 1964 11 Sep. 1964 p 71–91 refs (See N65-10051 01-30)

This article examines regimes of optimum motion for a point of variable mass with limited power in a uniform central field of gravitation. The investigation is based on the maximum principle. The fundamentals of the qualitative theory of optimum programing of exhaust velocity are discussed, with consideration of the limits of the range for changes in exhaust velocity. A solution of the problem of synthesizing the optimum control in the absence of limitations of the magnitude of the exhaust velocity is also discussed. Author

N65-10056# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

FASTEST DECELERATION OF THE ROTATION OF AN AXISYMMETRIC SATELLITE

I. V. Ioslovich *In its* Cosmic Res., Vol. 2, No. 4, 1964 11 Sep. 1964 p 92–96 refs (See N65-10051 01-30)

It is demonstrated that the equations of the variation problem of optimizing the curtailment of satellite rotation can be integrated for the sections of control constancy, and certain facts are presented to characterize the fibering of the phase space by surfaces composed of trajectories. D.E.W.

N65-10060# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

SCATTERING OF LIGHT IN A SPHERICAL ATMOSPHERE, III

I. N. Minin and V. V. Sobolev *In its* Cosmic Res., Vol. 2, No. 4, 1964 11 Sep. 1964 p 165–179 refs (See N65-10051 01-30)

The present article contains a study of the scattering of light in the atmosphere of a planet, with consideration of the curvature of the atmospheric layers. It is assumed that the coefficient of absorption diminishes exponentially with altitude. Expressions have been derived for the optical distances in the atmosphere. An approximate solution has been found for the problem of the scattering of light in an atmosphere bounded by a reflecting surface. This solution has been used to calculate the brightness of a planet close to the terminator and the brightness of the zenith when viewed from the surface of the earth for various zenith distances of the sun. Author

N65-10064# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

INVESTIGATION OF RADIATION WITH THE FLIGHTS OF THE "MARS-I" AND "LUNA-4" INTERPLANETARY AUTOMATIC STATIONS

S. N. Vernov, A. Ye. Chudakov, P. V. Vakulov, Ye. V. Gorchakov, Yu. I. Logachev et al *In its* Cosmic Res., Vol. 2, No. 4, 1964 11 Sep. 1964 p 202–216 refs (See N65-10051 01-30)

A brief description of the radiation-recording equipment carried aboard the Mars-1 and Luna-4 stations is given. The derived results are discussed. It was observed that at a distance of 0.24 au from the earth, the intensity of cosmic radiation remains virtually constant. Data are also presented on the intensity of cosmic rays for various periods of the solar-activity cycle. Author

N65-10081# Joint Publications Research Service, Washington, D.C.
INVESTIGATION OF SOME PARAMETERS OF TURBULENT MOTION BY RADAR OBSERVATION OF METEOR TRAILS
I. A. Delov, M. F. Lagutin, and I. A. Lysenko *In its* Izv. VUZov: Radiophys., No. 2, 1964 19 Oct. 1964 p 45–53 (See N65-10076 01-23) OTS: $6.00

Values for the basic statistical parameters characterizing turbulent motion are estimated. The daily variations of some parameters are investigated. Author

N65-10160# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, N.Y.
INTENSITIES OF 9.4μ AND 10.4μ CO_2 BANDS
S. I. Rasool *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 55–57 refs (See N65-10155 01-29)

The intensities of the 9.4μ and 10.4μ CO_2 bands have been computed theoretically using, as the basis of the calculation, the line profiles at the centers of these bands published by Migeotte, Neven, and Swensson (1957). The band intensity values thus obtained are as follows: 9.4μ band—0.0180 cm^{-2}-atm^{-1} at 265° K; and 10.4μ band—0.0098 cm^{-2}-atm^{-1} at 265° K. The ratio of the two band intensities is 1.84, which is closer to the value of 1.7 given by Kostkowski (1955) than to 2.4 reported by Penner (1959). Author

N65-10167# Liège U. (Belgium) Institut D'Astrophysique
PRACTICAL POSSIBILITIES OF PLANETARY SPECTROSCOPIC OBSERVATIONS BY INTERFEROMETRY
L. Delbouille, G. Roland, and H. A. Gebbie (Nat. Phys. Lab., Teddington, Gt. Brit.) *In its* Infrared Spectra of Astron. Bodies 1964 p 125–129 refs Partially Sponsored by USAF Cambridge Res. Labs. (See N65-10155 01–29)

A spectrum of Jupiter in the near infrared, obtained using two-beam interferometers and Fourier analysis, is presented as an example of preliminary results with this method. In spite of its advantages in speed and sensitivity, experimental problems have been encountered, especially in astronomical work through the atmosphere. A review of these problems includes, the following: (1) the effect of source noise (scintillation, etc.) on the spectrum of detector noise; (2) increased probability of distortion of the instrumental profile by some electrical or mechanical disturbance when the number of sampling points is increased in an attempt to reach high resolution; and (3) variations in the interferometer zero-path difference point with wavelength, so that an instrumental profile valid for one wavelength is distorted for another wavelength. Possible solutions to these problems are indicated. M.P.G.

N65-10181# Arizona U., Tuscon Lunar and Planetary Lab.
INFRARED SPECTRA OF PLANETS AND COOL STARS: INTRODUCTORY REPORT
Gerard P. Kuiper *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 365–391 refs (See N65-10155 01-29)

Spectral measurements made with a modified Ebert-type spectrometer are discussed. The modified Ebert-type spectrometer is equipped with a set of interchangeable photoelectric and photoconductive cells that have various target areas, a wheel carrying a set of filters (eliminating unwanted orders), and various scanning rates and time constants. Spectra of Mars, the Sun, Jupiter, Vega, X Cygni, Omicron Ceti (Mira), and Betelgeuse are presented. P.V.E.

N65-10182# Paris Observatory, Meudon (France)
MEASUREMENT OF WATER VAPOR IN THE ATMOSPHERE OF MARS AND VENUS [MESURE DE LA VAPEUR D'EAU DANS LES ATMOSPHERES DE MARS ET DE VENUS]
A. Dollfus In Liège U. Infrared Spectra of Astron. Bodies 1964 p 392–395 *In* FRENCH (See N65-10155 01-29)

Attempts to measure the water vapor on Mars and Venus using photometric equipment for the 1.4μ radiation of the H_2O molecule are described. The data presented were obtained using this equipment both in balloons and on high mountains. Comparisons of Mars and lunar observations gave a different signal that, when corrected for brightness inequalities and instrumental effects, indicate that water vapor exists in the Mars atmosphere at a concentration of 2.6×10^{-2} g/cm^2. In the case of Venus, the water-vapor band was found to be juxtaposed with strong carbonic gas bands. Appropriate filtering out of the CO_2 bands confirmed the estimate of water vapor in the upper layers of the Venus atmosphere as the value 1.15×10^{-2} g/cm^2, assuming that the atmosphere is saturated to the level of the clouds. M.P.G.

N65-10183# RAND Corp., Santa Monica, Calif.
THE WATER CONTENT OF VENUS INFERRED FROM HER MICROWAVE BRIGHTNESS
D. Deirmendjian *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 397–405 refs (See N65-10155 01-29)

A recent theoretical evaluation of the microwave attenuation, albedo of single scattering, angular distribution, and polarization properties of terrestrial water clouds and precipitation is discussed with respect to its implication for the problem of Venus. On the basis of the preliminary analysis presented, the following conjectures for the nature of the Venusian atmosphere are presented: (1) The invisible surface of Venus radiates as a blackbody with a 600° to 800° K temperature, the source of the energy being at the surface or the planetary interior. (2) The planet is covered by a continuous and optically deep cloud layer of ice crystals and water droplets that can reach the size of raindrops. The cover allows very little of the surface radiation to escape to space and, conversely, a negligible amount of solar energy reaches the surface. P.V.E.

N65-10184# Sternberg Astronomical Inst., Moscow (USSR)
RECENT OBSERVATION OF INFRARED SPECTRA OF PLANETS (VENUS 1–4 μ, MARS 1–4 μ, JUPITER 1–1.6μ)
V. I. Moroz *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 406–419 refs (See N65-10155 01-29)

Spectra of Venus were observed in 1962–1963 with the 50-in. reflector by means of grating and prism spectrometers with a resolution $\Delta\lambda \simeq 24$ to 40 Å in the region 1μ to 2.6μ and $\Delta\lambda \simeq 900$ Å in the region 2.8μ to 3.8μ; spectra of Mars with resolution $\Delta\lambda \simeq 40$ to 60 Å in the region 1μ to 2.6μ and $\Delta\lambda \simeq 900$ Å in the region 2.8μ to 4.1μ; spectra of Jupiter with resolution 40 Å in the region 0.9μ to 1.1μ and 80 Å in the region 1.2μ to 1.6μ. In the spectra of Venus CO absorption equivalent to 4 cm atm NTP and several unidentified absorption bands are found. The albedo of Venus decreases by a factor of 20 from λ 2.5μ to 2.9μ. The absorption observed for $\lambda > 3\mu$ creates large greenhouse effect, which heats the planetary surface. A number of new CO_2 bands are found in the spectrum of Mars with the band $C^{13}O_2^{18}$ at 2.11μ among them. Author

N65-10185# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena Space Sciences Div.

AN ANALYSIS OF THE SPECTRUM OF MARS

Lewis D. Kaplan, Guido Münch, and Hyron Spinrad *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 420–423 ref (See N65-10155 01-29)

On a high-dispersion spectrogram of Mars taken at Mount Wilson, rotational lines of H_2O near λ 8300 and CO_2 λ 8700 were detected. Recent laboratory measurements of line strengths were used to determine the amounts of H_2O and CO_2 in the atmosphere of Mars: 14 $\pm$ 7μ precipitable water and 55 $\pm$ 20 meter atmospheres CO_2. From the absence of O_2 in the Martian spectra, an upper limit of 70 cm-atmospheres for the O_2 content was set. By suitably combining the CO_2 amount with observations by Sinton of the strongly saturated bands in the 2μ region, a surface pressure of 25 $\pm$ 15 mb was derived. Author

N65-10187# ITT Federal Labs., San Fernando, Calif.

RESULTS OF AN INFRARED STELLAR MAPPING PROGRAM

Freeman F. Hall, Jr. *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 432–459 refs (See N65-10155 01-29)

The results of a scan of the night sky in three spectral regions of the infrared, 1.3μ to 3.0μ, 3.0μ to 4.0μ, and 8.0μ to 13.0μ are presented. A 50.8-cm-aperture radiometer with instantaneous field of view 1/4° × 1/4° with a nodding newtonian secondary mirror was used in the study. Eighteen percent of the sky was scanned in the near IR. Several bright IR sources, such as Boss GC 30482, were detected that would not have been expected on the basis of extrapolation of their visual properties and assumed temperatures. It is shown that such extrapolation of the supposed blackbody properties of stars to predict infrared magnitudes becomes progressively less reliable for the cooler stars, and may fail by many magnitudes for the M7 and M8 classifications. Author

N65-10192# Naval Observatory, Washington, D.C.

PROPOSED STUDIES OF LATE TYPE STARS

K. Aa. Strand and Stewart Sharpless *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 497–500 refs (See N65-10155 01-29)

This paper describes a 61-inch astronomic reflector of a fork type, with an unequal armed parallelogram truss of the Serrurier type for the tube, and with a flat secondary mirror. The coma-free field of the telescope had a diameter of 30 minutes of arc. In addition to the cameras for direct photography, the instrumentation also consisted of a photoelectric photometer to be used for studies of galactic clusters, of an f/2 Cassegrain camera to carry out H-alpha surveys and the composite photography of galaxies, and of a spectrograph for the determination of parallaxes gf M-type supergiants, and of F, G, K supergiants. G.G.

N65-10193# Cornell U., Ithaca, N.Y. Center for Radiophysics and Space Research

INFRARED APPEARANCE OF DIFFERENT ZODIACAL CLOUD MODELS

Martin Harwit *In* Liège U. Infrared Spectra of Astron. Bodies 1964 p 506–519 refs (See N65-10155 01-29)

(NSF-GP-1338)

The observed infrared intensity distribution of zodiacal clouds was expressed in dust-density distributions by simple symmetry observations, and models of dust distribution are presented. Zodiacal emission proves to be a serious problem to infrared observations from above the atmosphere, and calculations were made to find the proper distance at which the reemitted radiation from the interplanetary dust is negligible. It was concluded that the involved radiation power of the zodiacal dust is comparable to the power scattered in the visible part of the spectrum, and leads to a considerable error in astronomical observations utilizing the infrared spectrum. G. G.

N65-10275# Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center

INVESTIGATIONS ON THE COLORIMETRY OF THE MOON, PARTS I AND II

V. V. Sharonov 22 Sep. 1964 30 p refs Transl. into ENGLISH from Vestn. Leningr. Univ. (Leningrad), v. 10, no. 11, 1955 p 113–120; v. 11, no. 1, 1956 p 155–167

(RSIC-283; AD-607393)

Observations of the optical features of the outer core of the lunar surface by visual colorimetry of the moon have proved to be highly accurate and effective. The colorimetric parameter values were used to evaluate the differences in the curves of the spectral distributions. A comparison of the color of the sun with the color of the moon was made, and it was concluded that the color of moonlight does not vary as a function of the moon phase. Spectrophotometric observations, in agreement with colorimetric data, made it possible to reject the presence of extensive sedimentary, as well as acidic, magnetic soil mantles on the moon, the coloring of which would be similar to terrestrial rocks of the same composition. On the contrary, it was concluded that the hypothesis of the presence of lava mantles on the moon must be further developed. G.G.

N65-10302*# National Aeronautics and Space Administration, Washington, D.C.

PROBLEMS OF THE MOVEMENT OF LARGE METEORIC BODIES IN THE ATMOSPHERE

V. A. Bronshten Nov. 1964 133 p refs Transl. into ENGLISH of the book "Problemy Dvizheniya v Atmosfere Krupnykh Meteoritnykh Tel" Moscow, Izd. Akad. Nauk SSSR, 1963

(NASA-TT-F-247) OTS Prices: HC $2.75/MF $1.00

The objective of this paper is to systematize and bring into clear focus the basic elementary processes originating in a shock wave and in the course of its interaction with a meteorite. Particular attention is devoted to the kinetics of ionization and to its influence on the temperature distribution within the shock wave. Author

N65-10304*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

LUNAR ENVIRONMENT: AN INTERPRETATION OF THE SURFACE OF THE MOON AND ITS ATMOSPHERE

John R. Rogers and Otha H. Vaughan, Jr. 3 Sep. 1964 126 p refs

(NASA-TM-X-53124) OTS Prices: HC $4.00/MF $1.00

Under the heading of lunar topographic features, comparative analyses have been made of several geological classifications of lunar features based on inferred age relationships. A discussion of the major landforms, continents and maria, is included. The genetic classification, based on inferred geological origin of the various lunar landforms, attempts to compare by analogy certain lunar features with their interpreted terrestrial counterparts. Author

N65-10410# Army Dept., Washington, D.C.
MISSILES AND VENTURES INTO SPACE Progress Report 1962–1963
31 Oct. 1963 125 p *Its* Pamphlet 70-5-11 GPO: $0.70

Presented are extracts and abstracts from articles and papers dealing with the following subjects: (1) trends in the national space effort; (2) development and capabilities of the various missiles–space projects and programs; (3) missile and space efforts of other free nations; (4) the U.S.S.R. space program; (3) missile and space efforts of other free nations; (4) the U.S.S.R. space program; (5) the trends and developments in missiles, rockets, and space vehicles; (6) new areas of space exploration; (7) space as a battlefield; (8) disarmament aspects and arms control; (9) documents and congressional hearings reports; and (10) reference works and source materials. Also included are brief descriptions of Soviet missiles, space boosters, and space vehicles. P.V.E.

N65-10447# Collins Radio Co., Cedar Rapids, Iowa
RADIOMETRIC INSTRUMENTATION TECHNIQUE STUDY
W. H. Bellville Wright-Patterson AFB, Ohio, Res. and Technol. Div., May 1964 109 p refs
(Contract AF 33(616)-8109)
(CRR-278; RTD-TDR-63-4228; AD-604686)

This report considers the use of microwave radiometric equipment to determine the orientation of the line passing through the center of the moon, the earth, and the sun when the observation position is located in cislunar space. The errors in such determination are examined as a function of receiver–antenna parameters, operating wavelength, radial range of the receiver from the source body, and the thermal emission variations of the source. Because emphasis is on general applicability of radiometric instrumentation, servo errors are excluded from analysis. Considered are the electronic tracking error, due to finite receiver threshold sensitivity, and the error due to equivalent emission center shift, caused by source emission variations. Also investigated were the transitional problems associated with wide variations of radial range from the source and the possibility of obtaining range information by a passive equipment. Author

N65-10454# Aerospace Corp., El Segundo, Calif.
LOCATION OF CATCH-UP POINT BETWEEN A Δ V PERTURBED ORBIT AND THE ORIGINAL CIRCULAR ORBIT
A. H. Milstead 25 Apr. 1963 12 p refs
(Contract AF 04(695)-169)
(TDR-169(3550-40)TN-4; SSD-TDR-63-225; AD-442562)

If two bodies are traveling together in a circular orbit and a retrograde impulse is applied to one body, then that body moves behind the unperturbed body in angular position. However, it is obvious that the perturbed body, being in a smaller period orbit, passes the unperturbed body in angular position at some angular distance from the point at which the impulse is applied. This note defines that angular catch-up position as a function of the magnitude of the perturbing force. Author

N65-10552# American Meteorological Society, Boston, Mass.
SOME PROPERTIES OF THE MARTIAN ATMOSPHERE INDICATED BY SPECTROPHOTOMETRIC OBSERVATIONS OF 1956 [O NEKOTORYKH SVOISTVAKH ATMOSFERY MARSA po SPEKTROFOTOMETRICHESKIN NABLIUDENIIAM 1956 GODA]
N. A. Kozyrev Bedford, Mass., AFCRL, Mar. 1964 9 p ref Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (Moscow), no. 18, 1958 p 61–65
(Contract AF 19(628)-3880)
(T-R-429; AD-602183) OTS: $1.00

In 1956, the contrast of the surface details of Mars decreased sharply, while the general color of the planet changed but little. It is concluded that the atmosphere became turbid only in the lowest layers, and that no essential changes took place in the general optical properties of the atmosphere itself. Spectrograms of the polar cap, made in the second half of September and early October, showed it to be an atmospheric formation resulting from the condensation of the particles that cause normal scattering in the upper layers of the Martian atmosphere. Author

N65-10574# United Aircraft Corp., East Hartford, Conn. Research Labs.
SECOND APPROXIMATION TO THE SOLUTION OF RENDEZVOUS EQUATIONS
H. S. London Dec. 1962 18 p refs
(A-110058-8)

The differential equations describing the ballistic motion of a satellite relative to a second satellite that is in a circular orbit are solved to second order by the method of successive approximations. The resulting solutions provide a correction to the first-order solutions previously derived by other authors. Numerical results utilizing this second-order approximation show significantly better agreement with data obtained by numerical integration of the exact equations than the first-order theory alone for conditions typical of rendezvous situations. Author

N65-10590# Aerospace Corp., El Segundo, Calif.
LAUNCH VEHICLE PERFORMANCE REQUIREMENTS FOR RENDEZVOUS WITH SATELLITES IN 200-NAUTICAL MILE CIRCULAR POLAR ORBITS
G. L. Coates 20 Sep. 1963 36 p refs
(Contract AF 04(695)-169)
(TDR-169(3511)TN-5; SSD-TDR-63-233; AD-422969)

This report presents a detailed analysis of direct-ascent rendezvous with polar orbits, illustrating quantitatively the effects of range angle, launch azimuth, and satellite epoch on the ascent trajectory and on the performance required of the launch vehicle. The total ideal velocity capability required of the launch vehicle to achieve gross rendezvous with satellites in 200-nautical mile, circular, polar orbits was determined as a function of the launch azimuth, the relative epoch of the orbit, and the pass on which rendezvous takes place. A direct-ascent launch-vehicle trajectory was assumed. Precision flight-simulation techniques were used throughout, except for the assumption of an impulsive adaptation maneuver. Launch-window effects were not included; rather, the study was concerned with the selection and characteristics of nominal trajectories. Author

N65-10628*# National Aeronautics and Space Administration, Washington, D.C.
THE SPACE PROGRAM'S INTERNATIONAL FACTOR News Release
James E. Webb 17 Nov. 1964 20 p Address presented at the Council on World Affairs, Dayton, Ohio Available from the Scientific and Technical Information Division

In discussing the space program's international factor, Mr. James E. Webb discusses the impact of the space age on all areas of the earth. The benefits from the space projects to mankind are pointed out. The prime objective of the Apollo program is the gain in preeminence in space for the U.S.A. In considering the NASA space program from the viewpoint of international relations, the following objectives are pointed out: (1) to acquire sufficient knowledge and competence in space science and technology to assure our national security

and well-being; (2) to use space to reduce international tensions and to build communities of interest and patterns of cooperation; and (3) to find and employ effective means for increasing the use of space technology for peaceful purposes to benefit mankind. G.G.

N65-10639* Israel Program for Scientific Translations, Ltd., Jerusalem
FUNDAMENTAL CONSTANTS OF ASTONOMY
K. A. Kulikov 1964 221 p refs Transl. into ENGLISH of the book "Fundamental'nye Postoyannye Astronomii" Moscow, Gos. Izd. Tekhn.-Teoret. Lit., 1956 Published for NASA and NSF
(NASA-TT-F-143; OTS-64-11022) OTS: $2.25

This is a study of the fundamental constants of astronomy and of the methods for their determination that are suitable for astronomy students and postgraduates. The following topics are presented: "Basic Notions"; "Fundamental Constants Related to the Earth"; "The Solar Parallax"; "The Velocity of Light"; "Aberration of Light"; "Precession"; "Nutation"; "Parallax and Mass of the Moon"; "Masses of the Major Planets"; "The System of Fundamental Constants"; "The Rotational Motion of the Earth"; and an appendix with a "Summary of the Determinations of Some Fundamental Constants." G.G.

N65-10783# Naval Observatory, Washington, D.C.
PROVISIONAL EPHEMERIS OF MARS 1800–1950
R. L. Duncombe 30 Apr. 1964 82 p *Its* Circular No. 95

N65-10784# Naval Observatory, Washington, D.C.
PHYSICAL EPHEMERIS OF MARS 1877–1967
Victoria Meiller 12 Jun. 1964 87 p *Its* Circular No. 98

N65-10785# Naval Observatory, Washington, D.C.
EPHEMERIS OF THE RADIO LONGITUDE OF THE CENTRAL MERIDIAN OF JUPITER, SYSTEM III (1957.0)
Berenice L. Morrison 19 Apr. 1964 5 p *Its* Circular No. 94

N65-10786# Naval Observatory, Washington, D. C.
GEOCENTRIC DISTANCE AND VELOCITY OF VENUS 1961–1970
R. L. Duncombe, W. J. Klepczynski, and T. Van Flandern 15 May 1964 34 p *Its* Circular No. 96

Quantities for use in the reduction and interpretation of observations of the geocentric distance and velocity of Venus from 1961 to 1970 are presented. The tabular quantities, referred to Ephemeris time, are the Julian date, the geocentric distance to the center of mass of Venus in astronomical units, and the geocentric velocity in astonomical units per day. The correction value that may be used to reduce the velocity to the time scale of Universal Time is also given. M.P.G.

N65-10787# Naval Observatory, Washington, D.C.
TABLES OF POLARIS AND THE EQUATION OF TIME 1965–1966 Circular No. 97
29 May 1964 50 p

N65-10789# Osservatorio Astronomico di Roma (Italy)
THE ROME ASTRONOMICAL OBSERVATORY
Massimo Cimino 1964 57 p refs *Its* Contrib. Sci., Ser III, No. 25

This is an overall report concerning the three complexes of the Rome Astronomical Observatory. The historical background is presented, famous astronomers and their work at the observatories are described, and the different instrumentations are detailed. G.G.

N65-10860*# National Aeronautics and Space Administration, Washington, D.C.
THE ENHANCEMENT OF HUMAN EXPLORATION BY MEANS OF SPACE FLIGHT An Address
Edgar M. Cortright [1964] 74 p Presented before the Norweg. Geograph. Soc., 27 Sep. 1964

This paper gives an overall survey of the exploration of space. Mr. Edgar M. Cortright describes the various satellites and their objectives. Terrestrial and lunar photographs that were taken from spaceships are presented and discussed. The missions of future manned and unmanned space flights are observed. G.G.

N65-10939# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A METHOD OF APPROXIMATION FOR CALCULATING THE ORBITS OF SPACE ROCKETS
I. Almar, B. Balazh, and K. Tot 30 Dec. 1963 27 p refs Transl. into ENGLISH from Byul. Inst. Teor. Astron. (USSR), v. 8, no. 6, 1962 p 405–420
(FTD-MT-63-198; AD-602555)

By means of the "principle of spheres" the movement of a space rocket is divided into sections, inside of which solutions of a problem of one center are applied. Methods are presented by which the total trajectory can be rapidly reconstructed on the basis of certain data about the position of the rocket, communicated directly after its launching. For ease of facilitating calculations nomographs are given. Given as an example is the calculation of the trajectory of the space rocket, launched 2 January 1959, and the trajectory of the automatic interplanetary station, launched 12 February 1961. The method is shown by which it is possible at any given moment to determine the position and angular velocity of a space rocket for the purpose of its optical observing it. Author

N65-10955*# National Aeronautics and Space Administration, Washington, D.C.
NASA ENGINEERING MODELS OF THE MARS ATMOSPHERE FOR ENTRY VEHICLE DESIGN
George M. Levin, Dallas E. Evans, and Victor Stevens, ed. Nov. 1964 51 p refs
(NASA-TN-D-2525) OTS Prices: HC $1.50/MF $0.50

In an effort to standardize atmosphere models used in Mars mission analyses and thus facilitate interpretation of such analyses, tentative engineering models for the Mars atmosphere are proposed. The emphasis is on the entry aspect of the mission. Three models having pressures at the planet's surface of 10, 25, and 40 mb are presented in both tabular and graphic form. An atmosphere model for use in terminal descent calculations is also presented. The atmosphere models are presented in both English and metric units in terms of eight variables as a function of altitude. These model atmospheres are based, insofar as possible, on experimentally obtained data and are not envelopes drawn around existing models of the Mars atmosphere. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N65-10042*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MISSION OPERATIONS PLAN NIMBUS A
H. Press Jun. 1964 354 p
(NASA-TM-X-55100; X-650-64-160) OTS Prices: HC $7.00/MF $1.75

Described is the Nimbus A Program, including a description of the spacecraft, vehicle, and aerospace ground equipment; the project organization; spacecraft and vehicle operations during prelaunch, launch, and postlaunch phases; GSFC operations, including communications, control-center activities, and orbital computing and acquisition predictions; field-station operations, including tracking, data acquisition, and data handling; Automatic Picture Transmission Station operations; the Weather Bureau's plan for data processing and archiving; and the GSFC plan for the HRIR experiments. R.L.K.

N65-10582# Radio Corporation of America, Princeton, N.J.
RESEARCH TO COMPILE UNPUBLISHED SPACE MATERIALS INFORMATION PERTAINING TO RCA SPACE CAPSULE PROGRAM
A. W. Batchler Wright-Patterson AFB, Ohio, AF Mater. Lab., Oct. 1963 98 p
(Contract AF 33(657)-8881)
(ASD-TDR-63-265; AD-423169)

This report includes a compilation of monographs on "Metals and Coatings" and "Bondings and Encapsulations", and a "Materials Summary." The materials information presented refers to the resins, silicone rubber compounds, surface coatings, and metals that were used on TIROS I, II, III, and IV. Each of the materials is described in detail including such information as physical properties, electrical properties, formulations, procedures for mixing, uses, preparation of surfaces, application of mixtures, cure cycles, and the methods of testing used to determine all values. Author

N65-10584# IIT Research Inst., Chicago, Ill.
INVESTIGATION OF LOCATION AND RETRIEVAL CRITERIA FOR RE-ENTRY CREW ESCAPE SYSTEMS Technical Documentary Report, Dec. 1, 1962–Jan. 31, 1964
J. A. Campbell and J. V. Capuzzo Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Mar. 1964 100 p refs
(Contract AF 33(657)-10103)
(FDL-TDR-64-51; AD-603759)

The equations of motion for escape capsules having lift-to-drag ratios ranging from 0.2 to 2.0 were solved to determine the ground area attainable for these capsules returning to earth from 300 n. mi. equatorial, polar, 30°, and 60° circular orbits. The landing capabilities of these capsules with respect to the probability of a successful recovery of the downed crew were then determined. This study indicates that an escape capsule with an L/D ratio of 1.0 represents the simplest escape capsule that would have enough maneuvering capability to reach suitable landing areas. A state-of-the-art avionics investigation was made to determine the location of existing tracking and location radars, portable emergency radios, direction-finding equipment, and acoustic and visual aids that would aid in the quick location and retrieval of a downed crew. An escape system concept is presented, emphasizing that the successful conclusion of escape requires the determination of the necessary maneuver to reach a desirable landing area, the physical execution of that maneuver, and the transmission of escape information to recovery forces. Author

N65-10629*# National Aeronautics and Space Administration, Washington, D.C.
SCOUT TO LAUNCH AIR DENSITY AND INJUN SATELLITES News Release No. 64-284
13 Nov. 1964 22 p Available from the Scientific and Technical Information Division

The purpose of the dual-satellite experiment, labeled Air Density–Injun Explorer B (AD/I-B), is to provide more detailed information on complex radiation–air density relationships in the upper atmosphere. In orbit, the 136-pound payload separates into a 12-foot polka-dotted sphere for air-density and atmospheric-heating measurements and a 2-foot-diameter satellite-bearing particle detector to measure the bombardment of the atmosphere by energetic particles from space. Measuring particle flux and energy and the atmospheric density, at the same time and in the same general location, the dual-satellite experiment provides data that can be compared, and from which interrelationships can be interpreted. The satellites and their mission sequence are described. R.L.K.

N65-10634*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
RENDEZVOUS CAPABILITY OF HORIZONTAL-TAKE-OFF LAUNCH VEHICLE WITH AIR-BREATHING PROPULSION
Charlie M. Jackson, Jr. Washington, NASA, Nov. 1964 23 p refs
(NASA-TN-D-2509) OTS Prices: HC $0.75/MF $0.50

A simplified closed-form analysis was made in order to calculate the offset launch capability and allowable launch-time error. Although a more detailed investigation would undoubtedly indicate additional improvements in the rendezvous capability, the present analysis gives an indication of this capability that is consistent with the accuracy of current component performance estimates for such a vehicle. The results indicate large increases in offset launch capability for a vehicle with aerodynamic lift and air-breathing propulsion in comparison with that of a vehicle utilizing an orbital-plane-change maneuver. The maneuver associated with the improved offset capability of the air-breathing launch vehicle is, however, not without problems. Aerodynamic heating is a serious constraint, inasmuch as the most efficient cruise velocities are consistent with the most severe heating conditions. Influence coefficients were determined for the significant parameters assumed for this analysis, and none were found to be so important that reasonable variations would affect the consideration of offset capability as an advantage for the horizontal-takeoff launch vehicle with air-breathing propulsion. Investigation of the allowable launch-time error with respect to reduction of the maximum time in the parking orbit indicated that for a target orbit at an altitude of 300 n. mi., a reduction of only a few hours was possible with an orbital phasing maneuver or a combination aerodynamic-orbital phasing maneuver. A comparison of the two types of maneuvers indicated no distinct advantage for either. Author

N65-10802* # National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISON OF EXPERIMENTAL VIBRATION CHARACTERISTICS OBTAINED FROM A 1/5-SCALE MODEL AND FROM A FULL-SCALE SATURN SA-1
John S. Mixson and John J. Catherine Washington, NASA, Nov. 1964 41 p refs
(NASA-TN-D-2215) OTS Prices: HC $1.00/MF $0.50

In order to explore the feasibility of using reduced-scale models, in place of the usual full-scale vehicle, to obtain the necessary resonant frequencies, mode shapes, and damping, a 1/5-scale model of the Saturn SA-1 has been built and vibration tested at Langley Research Center. The results of these vibration studies of the 1/5-scale Saturn model are compared with results of a ground vibration survey of a full-scale Saturn vehicle performed at Marshall Space Flight Center. Comparisons of the model and full-scale vibration test results show that the model and full-scale first-bending-mode frequency parameters (obtained by multiplying the frequency in cycles per second by the vehicle length) are in agreement when the rigid-body rocking frequency parameters agree, that the model and the full-scale damping factors are approximately the same for most modes, and that the first three mode shapes are in qualitative agreement. The model and full-scale vehicles both exhibit a nonlinearity of the first-bending-mode response, which is characterized by a decrease in resonant frequency with an increase in vibration amplitude. Author

N65-10811# National Research Council of Canada, Ottawa Radio and Electrical Engineering Div.
INSTALLATION AND PERFORMANCE OF PAYLOAD IN BLACK BRANT 1 ROCKET AA-1-26 FIRED AT FORT CHURCHILL APRIL 1963
A. Staniforth and K. A. Steele Aug. 1964 34 p
(ERB-682)

The scientific payload and its installation in the rocket are described. The following instrumentation was included: (1) cosmic ray experiment concerned with the study of particles associated with auroral activity; (2) Langmuir probe for measurement of the fine structure of electron-density and electron-energy spectrum inside and outside auroral formations; (3) micrometeorite detector; (4) potential gradient experiment; (5) flux-gate magnetometer experiment concerned with measurements on components of the earth's magnetic field; (6) flight testing of a new radar beacon and of a rocket-borne light for obtaining trajectory data with ground-base cameras; (7) low-frequency accelerometer and temperature measurements of the nose cone environment; (8) timers for initiating ejection and extension of equipment; (9) telemetry calibrator unit for introducing alternate 0-V and 5-V reference levels to all continuous channels at 10-second intervals during flight; and (10) event oscillator unit for indication by means of telemetry of various events during the flight. Preliminary assessment of the results of the scientific experiments is given. R.L.K.

N65-10925# Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex. Inter-Range Instrumentation Group
METEOROLOGICAL ROCKET NETWORK FIRINGS. VOLUME XV: NOVEMBER 1962 FIRINGS Data Report
May 1964 143 p
(IRIG-109-62; Vol. XV; AD-451205)

This is a meterological data report from various earthbound ranges of November 1962. Observed were chaff dispersion and fall rate of Loki, Loki II, Arcas, and the Arcas–Robin configuration. Wind and altitude data were obtained from radar plotting grids through a graphical conversion of the sensor displacement during a standard time, and the wind profiles were gained by connecting each time interval computation. Temperature data were observed by a modified radiosonde transmitter, recorded with standard ground-detection equipment, and published in raw form. G.G.

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N65-10004# California U., Berkeley Inst. of Engineering Research
A STATIC-GEOMETRIC ANALOGUE IN THE THEORY OF COUPLE-STRESSES
P. M. Naghdi Jul. 1964 10 p refs
(Contract Nonr-222(81))
(AM-64-12; AD-604175)

A static-geometric analog is established in the presence of couple stresses, using the appropriate three-dimensional equations of equilibrium and compatibility for infinitesimal deformation. In the nonpolar case, the analog degenerates merely to the representation of the symmetric stress tensor in terms of a Gwyther–Finzi stress function. Author

N65-10007# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DEFINITION OF LOWER CRITICAL LOADS DURING LOCAL LOSS OF STABILITY OF THIN SHELLS
A. V. Sachenkov 25 May 1964 20 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekh. (Kazan), no. 4, 1962 p 111–122
(FTD-MT-63-292; AD-605879)

This study describes the development of formulas for the determination of the lower critical loads during local loss of stability of thin shells. The method is based on the separation of detecting the forms of bulging from the direct problem of determination of the critical load, and the modified Bubnov–Galerkin energy method for the resolution of nonlinear problems of stability was applied. The following formulas were developed: (1) for a cylindrical shell under the action of axial compression; (2) for a conical shell being compressed by force along the generatrices; (3) for a spherical shell and spheroid under action of a uniform external pressure; and (4) for an oblate ellipsoid under internal pressure. G.G.

N65-10032# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-12 Plant
WELDED REPAIR OF FILL AND DRAIN HOLES IN HIGH-CARBON STEEL GAS STORAGE CYLINDERS
J. C. Thompson and F. J. Lambert Nov. 1964 43 p refs
(Contract W-7405-ENG-26)
(Y-1468) OTS: $2.00

Stress calculations based on requirements for a 1500-psig working pressure indicated that 63 gas storage cylinders would be operating at or above the yield point of the base metal adjacent to their 3/4-inch fill and drain holes that are located in

the head knuckle radius. They would be subject to catastrophic failure since they are operating below their NDT, as shown by drop-weight tests on the base material. The cylinders were forged from steel having a nominal composition of 0.50% carbon and 1.60% manganese. Due to the composition of the metal and the fact that the plug-type repair would be accessible from one side only, a specialized welding procedure was developed to effect a full-penetration weld. Material used in the investigation was taken from a cylinder that was made available for the test. All test weldments received complete nondestructive inspection after fabrication in addition to the standard guided-bend test. Tensile, hardness traverses, metallography, drop weight, and impact tests were also utilized in the evaluation. Author

N65-10105*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
HIGH-IMPACT SURVIVAL
J. O. Lonborg 30 Sep. 1964 32 p refs
(Contract NAS7-100)
(NASA-CR-59412; JPL-TR-32-647) OTS Prices: HC $2.00/MF $0.50

The objective of the impact survival program is the development of the technology required to design and package electronic equipment to be capable of surviving hard impacts such as could occur in unmanned lunar and planetary landings. The experimental work includes component evaluation, component development, packaging investigations, and development of special shock test equipment and techniques. A solid state L-band transmitter was developed that is capable of surviving impacts of 5000 g with a velocity change of 200 fps. It is concluded that it is reasonable to attempt to design lunar and planetary landing capsule systems of moderate size and complexity for survival of impacts of the order of 1000 to 10000 g-peak amplitude at velocities of at least 200 fps. Author

N65-10107# Lockheed Propulsion Co., Redlands, Calif.
DESIGN, FABRICATION, AND HYDROTESTING OF A 120-INCH DIAMETER PRESSURE VESSEL USING 18 PERCENT NI MARAGING STEEL Final Report
L. E. Colbert 2 Oct. 1964 276 p refs
(Contract AF 04(611)-8525)
(LPC-609-F; RPL-TDR-64-82; AD-450114)

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1. DESIGN, FABRICATION, AND HYDROTESTING OF A 120-INCH DIAMETER PRESSURE VESSEL USING 18 PERCENT NI MARAGING STEEL L. E. Colbert 124 p refs

APPENDIXES

2. DATA DERIVED FROM REPORT ON METALLURGICAL RESEARCH IN SUPPORT OF THE CONSTRUCTION AND TESTING OF A 10 FT. DIAMETER PROTOTYPE PRESSURE VESSEL USING MARAGING 18 PERCENT NICKEL STEEL PLATES G. K. Bhat and W. J. Persin 31 p refs (See N65-10108 01-17)

3. METALLURGICAL ANALYSIS OF FRACTURED CLOSURE PLATE OF THE 120-INCH MARAGING STEEL PROTOTYPE VESSEL G. K. Bhat 75 p refs (See N65-10109 01-17)

4. FRACTURE ANALYSIS OF A HYDROBURST TESTED 120-INCH DIAMETER MARAGING STEEL PROTOTYPE VESSEL 46 p (See N65-10110 01-32)

N65-10110# Mellon Inst., Pittsburgh, Pa.
FRACTURE ANALYSIS OF A HYDROBURST TESTED 120-INCH DIAMETER MARAGING STEEL PROTOTYPE VESSEL Final Report
15 Jun. 1964 *In* Lockheed Propulsion Co. Design, Fabric., and Hydrotesting of a 120-inch Diameter Pressure Vessel Using 18 Percent Ni Maraging Steel 2 Oct. 1964 46 p Prepared for Lockheed Propulsion Co. (See N65-10107 01-32)

Analysis of fracture resulting from the testing of the large rocket-motor case yielded these primary conclusions. The fracture in the tested vessel seemed to have initiated near the center girth weld and in the longitudinal weld labeled L2. The fracture was predominantly ductile, exhibiting roughly 45° shear surfaces. The primary crack had spread in an austenite band located in the midplane of the plate. A cross check of ultrasonic flaw-location technique with metallurgical examination of flaw indication showed good correlation between the nondestructive and destructive examinations. Observations of microcracks and macrocracks, of point defects and porosity, indicated that the TIG welds in this vessel had adequate ductility to accommodate the defects. D.E.W.

N65-10201# Rolls-Royce Ltd., Littleover (Gt. Brit.)
STRESS DISTRIBUTION IN ROTATING DISCS WITH NON-CENTRAL HOLES
W. A. Green, G. T. J. Hooper, and R. Hetherington Jul. 1963 24 p refs
(RR(OH)104)

The stress distribution in rotating circular discs containing a central hole and a symmetrical array of noncentral holes is determined by numerical solution of the equations of generalized plane stress. Particular attention is given to an annulus containing the holes, approximately eight-hole diameters wide, in which the full two-dimensional equations are solved. The region outside this annulus is treated as radially symmetric, and the stresses there are determined from a simpler one-dimensional model. Stress distributions are reported for uniform discs of fixed geometry containing 10, 20, and 45 holes. Results are also obtained for 20 hole discs of nonuniform thickness comprising a uniformly tapered annulus containing the holes, and a uniform disc with each hole surrounded by thickened bases. Author

N65-10216# Naval Research Lab., Washington, D.C. Metallurgy Div.
IRRADIATION EFFECTS ON STRUCTURAL MATERIALS Quarterly Progress Report, 1 Feb.–30 Apr. 1963
L. E. Steele, J. R. Hawthorne, and H. E. Watson 15 May 1963 37 p refs
(Contract AT(49-5)-2110)
(NRL-1424; AD-420048)

This report includes the following: (1) a summary review of the data on neutron embrittlement for the several steels studied; (2) the effects of very high neutron dosage on two steels; (3) the effects of various heat-treatment conditions as well as cyclic irradiation–annealing treatments on the notch ductility properties of irradiated steels; (4) the calibration of the in-cell Charpy impact machine; and (5) the results of a shielding efficiency survey of the cells in the new Metallurgy High Level Radiation Laboratory. Author

N65-10236# Polytechnic Inst. of Brooklyn, N.Y.
TRANSIENT RESPONSE OF A PERIODICALLY SUPPORTED CYLINDRICAL SHELL IMMERSED IN A FLUID MEDIUM
Harry Herman and Jerome M. Klosner Jul. 1964 56 p refs
(Contract Nonr-839(17))
(PIBAL-690; AD-603862)

The dynamic response of a periodically simply supported, infinitely long, circular cylindrical shell to a pressure suddenly applied through the surrounding acoustic medium is investigated. The incident particle velocity is zero, and the pressure is

assumed to have a harmonic spatial variation parallel to the shell axis. The exact solution is obtained by use of a Fourier integral transform, and the resulting inversion integral is evaluated by numerical and asymptotic integration. Two solutions to the same problem are obtained by using a plane and a cylindrical wave approximation for the radiated field. The range of their applicability is investigated. For a steel shell in water, it is found that when the supports are placed three shell diameters apart, the use of the cylindrical wave approximation results in a 5% underestimation of the maximum deflection, but when the supports are placed one-sixth of a shell diameter apart the approximations are invalid. Author

N65-10235# Forest Products Lab., Madison, Wis.
METHODS FOR EVALUATING TENSILE AND COMPRESSIVE PROPERTIES OF PLASTIC LAMINATES REINFORCED WITH UNWOVEN GLASS FIBERS
Karl Romstad Aug. 1964 29 p refs Issued in cooperation with MIL-HDBK-17 Working Group on Plastics for Flight Vehicles
(Contract AF 33(657)-63-358; BUWEPS Order 19-64-8004 WEPS)
(FPL-052; AD-603486)

Methods of obtaining strength and elastic properties of plastic laminates reinforced with unwoven glass fibers were evaluated using the criteria of the strength values obtained and the failure characteristics observed. Variables investigated were specimen configuration and the manner of supporting and loading the specimens. Results indicate that satisfactory tensile failures can be obtained by reinforcing the shank portion of the tension specimen with 1/32-inch sheet aluminum. Variation of tensile specimen geometry was inconclusive, with partial failures always occurring in the shank portion. Difficulty was encountered in trying to obtain accurate compressive strength data on the composite material comprising these laminates. Some acceptable compression failures were obtained using a 5 1/8-inch-long specimen clamped at the ends and supported laterally by the standard FTM-406 jig. Failures varied for different laminates, indicating that resin properties may control failure when the material acts as a composite.
Author

N65-10236# Polytechnic Inst. of Brooklyn, N.Y.
TRANSIENT RESPONSE OF A PERIODICALLY SUPPORTED CYLINDRICAL SHELL IMMERSED IN A FLUID MEDIUM
Harry Herman and Jerome M. Klosner Jul. 1964 56 p refs
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N65-10246* Southwest Research Inst., San Antonio, Tex.
CORRELATION OF VARIOUS SUBCAVITATING HYDROFOIL FLUTTER PREDICTIONS USING MODIFIED OSCILLATORY LIFT AND MOMENT COEFFICIENTS
H. Norman Abramson and Carl G. Langner Jun. 1964 40 p refs
(Contract Nobs-88599)
(AD-603754)

Flutter calculations were performed for a simple, unswept, cantilever, subcavitating hydrofoil using theoretical two- and three-dimensional oscillatory coefficients, measured three-dimensional oscillatory coefficients, and various modifications of these coefficients. The conclusion based on comparisons of these calculations with the observed flutter speed is that theoretical predictions of hydrofoil flutter can be highly unconservative, indicating the need for more satisfactory flutter prediction techniques and reliance on flutter model testing.
Author

N65-10300# Joint Publications Research Service, Washington, D.C.
APPLICATION OF DIGITAL COMPUTERS IN STRUCTURAL MECHANICS
A. P. Filin 5 Nov. 1964 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. i Mashinostr. (Moscow), no. 2, Mar.–Apr. 1964 p 188–192
(JPRS-27244; TT-64-51499) OTS: $1.00

A summary is presented of a conference on the application of digital computers in structural mechanics. The conference considered the structural mechanics of rod systems, the theory of plates and shells, and the mechanics of the continuum.
P.V.E.

N65-10338# Brown U., Providence, R.I. Engineering Div.
LINEAR DISLOCATION ARRAYS IN HETEROGENEOUS MATERIALS Technical Rept. No. 9
Y. T. Chou Oct. 1964 19 p refs
(Contract AT(30-1)-2394)
(NYO-2394-9)

A simple class of dislocation pileups in materials composed of soft and hard phases is examined. The analysis is based on the assumption that an array of discrete dislocations may be replaced by a continuous distribution of elementary dislocations. Two special cases considered are a pileup of screw dislocations in the soft matrix against a welded boundary, and a pileup of edge dislocations against a slipping boundary, i.e., a boundary that can transmit normal, but not shear, stresses. In a heterogeneous material, the length of the piled-up array depends linearly on the number of dislocations in the pileup, as is the case in a homogeneous material. The number of dislocations in a given array, however, is generally less in the heterogeneous than in the pure matrix material. The results indicate that the two-phase material would work harden more than the pure matrix, provided the mean free path is not small.
Author

N65-10372*# Little (Arthur D.) Inc., Cambridge, Mass.
LIQUID PROPELLANT LOSSES DURING SPACE FLIGHT Final Report, Sep. 1, 1960–Sep. 30, 1963
Oct. 1964 307 p refs *Its* Rept.-65008-00-04
(Contract NASw-615)
(NASA-CR-53336) OTS Prices: HC $7.00/MF $1.75

Full reports are included on the performance of multilayer insulations for liquid-hydrogen tanks, the application of multilayer insulations to small tanks, the effect of meteoroid-bumper

debris on multilayer insulation, and the mechanical-test program for a load-bearing multilayer insulation system (of alternate layers of NRC-2 crinkled, aluminized-mylar radiation shields, and silicone-impregnated Fiberglas spacers). Also given are abstracts of earlier reports on the space environment and on the evaluation of meteoroid-bumper protection systems. R.L.K.

N65-10377# Technical Research Group, Inc., Melville, N.Y.
THE DYNAMIC CALCULATION OF LATERAL BENDING MOMENTS ON SHIPS IN OBLIQUE WAVES
A. I. Raff Mar. 1964 158 p refs
(Contract Nonr-3284(00))
(TRG-147-FR; AD-605459)

This paper describes a dynamical method for the calculation of lateral bending moments on ships in oblique waves. The equations of motion are formulated with allowance for three degrees of freedom, and all inertia, damping, and cross-coupling terms. The results are of the proper order-of-magnitude, but are not in exact agreement with the model experimental data available. G.G.

N65-10387# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PROPAGATION OF THERMAL STRESS IN AN ELASTIC-PLASTIC ROD
Yu. P. Suvorov 29 Jan. 1964 13 p refs Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), v. 27, no. 2, 1963 p 383–389
(FTD-MT-63-225; AD-606799)

The problem is solved for the propagation of stress waves in a semi-infinite elastic plastic rod due to sudden heating of the free end; considered is the dependence of the coefficient of thermal conductivity on the temperature (i.e., the nonlinear equation of thermal conduction is investigated), which involves the finiteness of the propagation speed of the heat in the rod. Calculations lead to quantitative features of the elastic solution that are compared with known earlier solutions. It is assumed that the material of the rod is incompressible and possesses linear hardening; mechanical properties are considered to be independent of temperature. Author

N65-10400*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL LATERAL VIBRATION CHARACTERISTICS OF A 1/5-SCALE MODEL OF SATURN SA-1 WITH AN EIGHT-CABLE SUSPENSION SYSTEM
John S. Mixson and John J. Catherine Washington, NASA, Nov. 1964 54 p refs
(NASA-TN-D-2214) OTS Prices: HC $1.50/MF $0.50

Resonant frequencies, mode shapes, and damping of a 1/5-scale dynamic model of the Saturn SA-1 vehicle are presented for two values of stiffness of the eight-cable suspension system, and for weight conditions simulating flight times of the full-scale vehicle from lift-off to booster burnout. The eight-cable suspension system used in this investigation was designed to simulate the suspension used in the ground vibration survey of a full-scale Saturn vehicle, so that model and full-scale vibration results could be compared on a "same suspension" basis. It is shown that the damping of the model is about the same with the eight-cable suspension as with the two-cable suspension previously used, and that the first bending-mode frequency and rocking-mode frequency are higher with the eight-cable suspension. The frequencies of the higher modes were not appreciably affected by suspension-system changes. The first bending-mode frequency and tip amplitude exhibited nonlinearities similar to those obtained with the two-cable suspension. An increase of shaker force from 13 pounds to 38 pounds decreased the first bending-mode frequency by about 4 percent, that is about the same magnitude as the increase of first bending-mode frequency caused by stiffening the suspension system. Author

N65-10419# David Taylor Model Basin, Washington, D.C. Structural Mechanics Lab.
HYDROSTATIC PRESSURE TESTS OF UNSTIFFENED AND RING-STIFFENED CYLINDRICAL SHELLS FABRICATED OF GLASS-FILAMENT REINFORCED PLASTICS
Kenneth Hom, John E. Buhl, Jr., and William P. Couch Sep. 1963 28 p refs
(DTMB-1745; AD-422520)

The results of a structural research program to investigate lightweight, glass-reinforced plastic laminates or composite materials for pressure hulls of deep-submergence vehicles are summarized. Unstiffened and ring-stiffened cylinders fabricated of commercially available reinforced plastics are described. Extensive studies of hydrostatic strength and limited studies of creep were conducted. The results of the hydrostatic tests agree well with pressures computed from formulas developed for isotropic materials. An effective modulus of elasticity of 5.5×10^6 psi and compressive stresses over 120 000 psi were measured from tests of the unstiffened cylinders. Results indicated that considerable weight saving in hull structure can be realized with glass-reinforced plastics. Author

N65-10445# Shock Hydrodynamics, Inc., Sherman Oaks, Calif.
ANALYSIS OF FLARE IMPACT ON LUNAR SURFACE
R. L. Bjork, Nancy B. Brooks, M. Rosenblatt, and L. Zernow Santa Monica, Calif., Douglas Aircraft Co., Jul. 1964 51 p refs Prepared under subcontract for Douglas Aircraft Co. substantiating data to SM-47954
(SM-47954)

A study was made of a triorthogonal disc configuration to be used as a chlorine trifluoride container for a lunar flare. Computations of a theoretical powder, soft lunar surface, and also of a hard-rock surface were made. The simulated container impacts against these two targets were studied by the use of an equation of state, which was based upon the particle-velocity determination at several pressures. It was concluded that the triorthogonal CTF flare configuration will perform satisfactorily against either a hard or a soft lunar surface. G.G.

N65-10449 Aeronautical Research Council (Gt. Brit.)
FATIGUE BEHAVIOUR UNDER SERVICE AND GROUND TEST CONDITIONS (A COMPARISON BASED ON THE DAKOTA WING)
W. J. Winkworth London, HMSO, 1964 43 p refs Supersedes RAE-TN-STRUCT-306, ARC-23963
(ARC-CP-666; RAE-TN-STRUCT-306, ARC-23963) HMSO: 10s

Several Dakota wings have been tested in fatigue under various conditions. The objective was to obtain an assessment of full-scale testing procedures. When the ground-to-air loading actions are represented in proper relation to those of atmospheric turbulence, the behavior in test is found to be similar to that in service. Author

N65-10458# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
FORCED OSCILLATIONS OF CYLINDRICAL SHELLS
R. L. Malkina 23 Sep. 1963 15 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekh. (Kazan), no. 4, 1960 p 51–60
(FTD-TT-63-742/1+2; AD-422603)

Discussed is a problem concerning forced oscillations of circular and noncircular closed cylindrical shells. The problem is solved for bending oscillations, originating under the effect of perturbation forces, normal to the center surface of the shell, whereby tangential inertia forces are not taken into consideration. The basic equations of hollow shells are used. Also discussed are axially symmetrical oscillations, which may originate only in a circular cylindrical shell. Both radial and tangential inertia and perturbation forces are considered. Author

N65-10503# Southwest Research Inst., San Antonio, Tex.
A CRITICAL RE-EVALUATION OF HYDRODYNAMIC THEORIES AND EXPERIMENTS IN SUBCAVITATING HYDROFOIL FLUTTER
Wen-Hwa Chu Jun. 1964 37 p refs
(Contract NObs-88599)
(AD-603751)

A review of relevant hydrodynamic information has been made, with emphasis on the possible cause of serious discrepancies between classical hydrodynamic theory and the experiments for subcavitating hydrofoils. The usefulness of the best available wind-tunnel and towing-tank force measurements is also discussed. It is believed that these data are unreliable, and that the completion of the force calculation based on the classical lifting-surface theory and subsequent flutter prediction for an actual flutter model is desirable. Some recommendations for possible future experimental research are also given. Author

N65-10512# Rensselaer Polytechnic Inst., Troy, N.Y.
PHYSICAL MODEL OF A 3-CONSTANT ISOTROPIC ELASTIC MATERIAL
W. H. Hoppmann, II and F. O. F. Shahwan Jun. 1964 26 p refs
(Contract DA-30-069-AMC-195(R))
(AD-603761)

A study is presented of the static deformation of a model of a supposed 3-constant isotropic elastic material that exhibits the phenomenon of couple stresses. A description of the design and construction of the physical model is given. The related theory is briefly summarized and used in order to determine the three independent elastic constants which characterize the model of the material. The specific constitutive equations are presented. Experimental results are given for the model loaded in a mode that may be called pure bending. Author

N65-10520# Stanford U., Calif.
CREEP INDUCED INSTABILITY IN STRUCTURES Technical Report No. 8
Robert L. Carlson Jun. 1964 31 p refs
(Contract Nonr-225(47))
(SUDAER-198; AD-605717)

A brief discussion of various formulations for analyzing creep effects in structures is presented, and detailed attention is directed toward problems involving creep-induced instability. The theory of Robotnov and Shesterkov is discussed, and it is noted that the application of their theory should be restricted to time intervals during which the change in average strain is small. An alternative formulation, which is not subject to this restriction, is proposed and applied to the problem of a compressively loaded column and to the problem of a compressively loaded plate. An application of the proposed analysis to available column-creep results is made, and a good correlation with data is obtained. Author

N65-10551# Minnesota U., Minneapolis Inst. of Technology
STEADY-STATE MOTIONS OF LARGE ELASTIC BODIES
W. H. Warner 5 Aug. 1964 15 p
(Contract Nobs-86783)
(AD-603743)

Some results from the mathematical treatment of damping in steady-state motion are summarized. It is shown that the assumption of the complex modulus for so-called hysteretic or material damping does not lead to any results not implicit in the usual mathematical approach to linear elastic vibrations; further, viscous or viscoelastic behavior for steady-state motion leads to the same treatment. An experimental program to help to determine the proper physical hypothesis is suggested. Also, a tentative approach is presented to the problem of establishing a sort of dynamic analog, at least for steady-state motions, to the static St. Venant's principle of elasticity theory. Author

N65-10555# California U., Livermore Lawrence Radiation Lab.
STUDIES IN MECHANICS OF NONLINEAR SOLIDS
Richard Dong (Ph.D. Thesis) Jun. 1964 124 p refs
(Contract W-7405-ENG-48)
(UCRL-12039)

Constitutive equations for nonlinear materials with memory have recently been formulated by a number of authors. In each case, stress is expressed as a tensor functional of the strain history. A functional can be thought of as a mapping of a set of functions onto another set of functions, the mapping being characterized by kernels appearing in the series expansion of the functional. In solid mechanics the functional equations are the constitutive equations of a material, and the kernels are material functions. In a nonlinear constitutive equation the material functions have multiple time arguments. Before constitutive equations can be used in analysis, the material functions must be evaluated. Several authors have proposed simplifications motivated by observed behavior of certain real materials and have proposed, and in some cases performed, experiments for measuring the simplified material functions. The simplifying assumptions that were made include one or more of the following: assuming Coleman and Noll's finite linear constitutive equation is applicable, assuming the material is incompressible, and assuming separability of the multiple time argument material functions with respect to each time argument. Author

N65-10571# Stanford Research Inst., Menlo Park, Calif. Poulter Labs.
SHOCK-WAVE ATTENUATION IN ELASTIC-RIGID FOAMS Technical Documentary Report, 1 Jul. 1962–1 Jul. 1963
John R. Rempel Kirtland AFB, N. Mex., Res. and Technol. Div., Oct. 1963 122 p refs
(Contract AF 29(601)-4363)
(RTD-TDR-63-3056; AD-423379) OTS: $2.50

Described are experimental techniques for the study of the response of foamed or distended materials to impact loading, as well as the results of applying these techniques to four different kinds of foam—polyurethane, aluminum, silica, and graphite. An approximate theory for calculating the behavior of elastic–rigid locking solids is developed and applied to the materials tested. Within certain limits, agreement with

experiment is good, and at least for some materials within a range of impact momenta, the internal pressure history can be logically related to measurements of quasi-static compression, although better agreement is possible when certain parameters are measured dynamically. Author

N65-10579# Forest Products Lab., Madison, Wis.
MECHANICS OF ADHESIVE BONDED LAP-TYPE JOINTS: SURVEY AND REVIEW Technical Documentary Report
Dieter Kutscha Wright-Patterson AFB, Ohio, AF Materials Lab., Oct. 1964 124 p refs
(Contract AF 33(657)63-358)
(ML-TDR-64-298; AD-607147)

This report presents a critical review made in the field of the design of adhesive bonded, lap-type joints. The study included a comprehensive survey and analysis of the literature pertaining to the theoretical and experimental analysis of lap joints, mechanical properties of adhesive film in joints, failure criteria for joints, and empirical methods of joint design. Author

N65-10581# Minnesota U., Minneapolis Inst. of Technology
RESPONSE OF LARGE ELASTIC BODIES TO VIBRATORY FORCES ON SMALL AREAS Progress Report, Oct. 1, 1962–Oct. 1, 1963
R. Plunkett and W. H. Warner [1963] 43 p refs
(Contract NObs-86783)
(AD-423339)

This study pertains to the formulation of the following: (1) formal solutions for stress and displacement for steady-state input loadings, and the comparison of these solutions for equipollent loading; and (2) the relationships between the three-dimensional theory and various beam and plate theories for striplike structures, with the intent to establish criteria for the use of approximate theories in the analysis of steady-state problems. The effects of various terminations on the input impedance and on the reflection coefficient for stress waves in long bars were experimentally investigated. A single pair of masses on a tapered end was found to be the most effective termination, and the input impedance of this combination was confirmed by the Fourier transform solution. G.G.

N65-10593# Minneapolis-Honeywell Regulator Co., Hopkins, Minn. Honeywell Research Center
TORSION OF A CIRCULAR CYLINDER IN COUPLE STRESS ELASTICITY Twenty-Fifth Technical Report
H. Cohen Jul. 1964 11 p refs
(Contract Nonr-4076(00))
(HR-64-274; AD-604189)

The equations of linear couple stress elasticity are applied to solve the torsion problem for a circular cylinder. It is found that the torsional rigidity, D, of very fine wires will be greater than predicted by the classical theory of elasticity, D_c, according to the relationship

$$D = D_c(1 + 8l^2/a^2),$$

where a is the radius of the wire and l is a length characteristic of the internal structure. Author

N65-10597# Atomics International, Canoga Park, Calif.
ANALYSIS OF STRESSES IN BELLOWS. PART I: DESIGN CRITERIA AND TEST RESULTS
W. F. Anderson 15 Oct. 1964 91 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-4527) OTS: $2.25

Design charts and systematic design forms are presented for simplified calculations to check the number of convolutions and thickness required to limit the deflection and pressure stress range in three types of bellows—convoluted bellows, convoluted bellows with reinforcing rings, and toroidal bellows. The design charts are based on the equations for stresses derived from an asymptotic solution for the equations of toroidal shells found in previously published literature. Proposed stress limitations to be used with the calculated stresses are based on those of the ASA code for pressure piping. Data from 108 fatigue tests at 70° F and 18 fatigue tests at 1200° F for all three types of bellows are presented. These data are evaluated statistically and justify use of the proposed allowable stresses. Author

N65-10622# General Testing Labs., Moonachie, N.J.
DETERMINATION AND EVALUATION OF STRESSES ON IN-PAVEMENT RUNWAY LIGHTING Final Report
Ivan M. Silver Jul. 1964 20 p
(Contract FAA/SRDS-PN-4-2295)
(RD-64-118)

An investigation was made to determine the shock and vibration levels that centerline runway lights experience in normal service. The tests were performed 1500 feet from threshold of Runway 13 at the National Aviation Facilities Experimental Center, Atlantic City, New Jersey. The results indicate that the natural frequency of the light assemblies are excited, and the magnitudes of these vibrations are considerably above the test amplitudes that have been employed for product evaluation. Author

N65-10626*# J. G. Engineering Research Associates, Baltimore, Md.
MODELLING OF SPACECRAFT UNDER RANDOM LOADING
Joshua E. Greenspon Washington, NASA, Nov. 1964 37 p refs
(Contract NAS5-3132)
(NASA-CR-132) OTS Prices: HC $1.00/MF $0.50

Modeling laws are derived for elastic structures, such as spacecraft–booster combinations, under random dynamic loading when the model is constructed of a material different from that of the full-scale vehicle. Damping is the major problem in using scale-model results to extrapolate full-scale response, but the analysis shows that the resonant limitation (ξ must be constant for a given material) is not serious for random loading, since the major response at each frequency of interest is usually composed of primarily resonant contributions in modes that are close to this frequency. However, material damping of the thermoelastic type cannot easily be scaled, nor can viscous air damping unless the tests are conducted in "thinner" air. When using model materials with high material damping, such as plastics, extreme care must be used to be sure that the joint or interfacial slip damping is modeled properly before applying the approximate modeling equations. M.P.G.

N65-10632*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LONGITUDINAL SPRING CONSTANTS FOR LIQUID-PROPELLANT TANKS WITH ELLIPSOIDAL ENDS
Larry D. Pinson Washington NASA, Nov. 1964 26 p refs
(NASA-TN-D-2220) OTS Prices: HC $0.75/MF $0.50

An analysis using linearized membrane theory has been made to obtain spring constants for ellipsoidal bulkheads to be used in longitudinal vibration analyses of liquid-propellant launch vehicles. A closed-form solution is presented for the volume increment and first moment of the volume increment

for two types of loading, namely, constant pressure and hydrostatic pressure. Plots are presented from which the volume increment, first moment of the volume increment, and spring constants for ellipsoidal bulkheads can be obtained. Use of the equations and plots is illustrated by an example. Author

N65-10646# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EFFECT OF THE HISTORY OF STRESSING ON THE STRESSED STATE OF A DOUBLE LAYER SHELL
I. Z. Palley 24 Sep. 1963 14 p refs Transl. into ENGLISH from the book "Voprosy Dinamiki i Prochnosti" Riga, Akad. Nauk. Latv. SSR, 1962 p 115–126
(FTD-TT-63-603/142; AD-422577)

The problem of a stressed state of a double-layer shell is presented. The stressing factors were reduced to the internal pressure, and to the irregular heating factor of the shell. The theory of small elastic–plastic deformations over sections was used synonymously for binding stresses and deformations, and the deformation and stress values were found by equations. G.G.

N65-10650# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands)
STRAIN MEASUREMENTS ON EIGHT FULL-SCALE WING CENTER SECTIONS
P. J. Sevenhuysen, A. Nederveen, and J. Schijve 20 Dec. 1963 47 p refs
(NLR-TM-S.610)

For an investigation on the equivalence of random and programed fatigue loads eight full-scale wing center sections were tested. Each fatigue test was preceded by a static test to check the similarity of the stress distribution in all tension skins. The results of these static tests are presented and an analysis of the trends observed is given. The maximum load in the static test was only slightly beyond the mean load of the fatigue tests. Author

N65-10751# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THERMAL FATIGUE OF CERTAIN TITANIC ALLOYS
In its Nonferrous Met. 29 Jun. 1964 p 172–179 refs (See N65-10737 01-17)

A study has been carried out of thermal fatigue of the titanic alloys OT 4 and VT 14 and of the nickel EI 435. It has been established that the heat resistance of titanic alloys at upper cycle temperatures up to 900° C is higher than for the nickel alloy EI 435. The formation of thermal-fatigue cracks at various upper cycle temperatures has been investigated, and it has been shown that the growth rate of these cracks increases with temperature. As the result of investigation of the microstructure and microhardness in the zone of the heating patch it has been found that when testing for thermal fatigue, substantial change in the structure and increase in the microhardness of titanic alloys appears where the structure becomes needle shaped. Author

N65-10791# Lessels and Associates, Inc., Waltham, Mass.
BUCKLING AND FAILURE STRENGTH OF PLATING PANELS LOADED IN SHEAR Final Report
F. C. Bailey 20 Sep. 1963 96 p refs
(Contract NObs-72290)
(TR-602/51(d); AD-423368)

Three series of tests to explore the shear buckling and failure characteristics of plating panels are reported. In the first series, unstiffened panels of three grades of steel and one of aluminum were tested in a balanced cantilever shear frame. Panel aspect ratio was 5 to 1, and width-to-thickness ratios varied from 30 to 160. The second series of tests involved aluminum panels 0.050 inches thick with single central stiffeners tested in the cantilever frame. Subdivided width-to-thickness ratio was 120 and aspect ratio 5 to 1. The replacable tee stiffeners covered a wide range of flexural rigidity. Elastic critical load only was determined. The final series of tests was performed in a square test frame loaded on a diagonal. Each panel was divided into five bays of 5:1 aspect ratio by tee stiffeners. Subdivided width-to-thickness ratios varied from 57 to 162. Stiffeners and plates were fabricated from Cor-Ten steel. A constant ratio of stiffener flexural rigidity to panel flexural rigidity was used for the bulk of the tests. Author

N65-10800# Texas A & M U., College Station
MEMBRANE ANALOGY FOR TORSION OF CYLINDRICAL BARS WITH A SLOTTED KEY-WAY
Herman Paul Meiners, Jr. (M.S. Thesis) May 1964 66 p refs
(AD-443895)

An analysis to develop an electrically conductive membrane for use in membrane analogy experiments and for determining the effects of increased depth of a slotted key-way on the torsion problem of a slightly distended elastic membrane, which is stretched over an opening of the same cross-sectional shape as the cylindrical bar, is considered. The torsional stress function was applied and related to the characteristics of the elastic membrane, which were also determined experimentally by the use of soap films. It was found that the soap-film torsion analogy can be applied for the solution of the torsion problem for cylindrical bars, which cannot be solved by rigorous mathematical methods alone. G.G.

N65-10804*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
EXPERIMENTAL INVESTIGATION OF SLOSH-SUPPRESSION EFFECTIVENESS OF ANNULAR-RING BAFFLES IN SPHERICAL TANKS
Irving E. Sumner Washington, NASA, Nov. 1964 22 p refs
(NASA-TN-D-2519) OTS Prices: HC $0.75/MF $0.50

An experimental investigation was conducted to determine the slosh-suppression effectiveness of rigid and flexible flat-plate annular-ring baffles in suppressing the fundamental antisymmetric mode of liquid oscillations in rigid spherical tanks having diameters of 32.0 and 9.5 inches. The baffles caused a variation in the fundamental frequency of liquid oscillations by effectively changing the tank geometry. The baffles were most effective in reducing the slosh forces and increasing the damping when the quiescent liquid surface was slightly above the baffle so that it remained submerged during the liquid oscillatory cycle. The optimum baffle width to tank radius ratio of those values investigated was 0.125. The experimental data are presented in terms of dimensionless parameters that generalized the results for a variation in tank diameter for specific values of baffle-width ratio, liquid-depth ratio, and excitation amplitude parameter. Author

N65-10809# Israel Inst. of Technology, Haifa
GENERAL INSTABILITY OF STIFFENED CIRCULAR CONICAL SHELLS UNDER HYDROSTATIC PRESSURE Technical Note No. 2
Menahem Baruch and Josef Singer Jun. 1963 73 p refs
(Grant AF-EOAR-62-61)
(TAE-28; AFOSR-532I; AD-419706)

Donnell-type equilibrium and stability equations are derived for stiffened, thin conical shells. The stiffeners are considered closely spaced, and are assumed to be "distributed" over the

whole surface of the shell. In the proposed theory the stiffeners and their spacing may vary in any prescribed manner, but here only equally spaced stiffeners are dealt with. The force and moment strain relations of the combined stiffener-sheet cross section are determined by the assumption of identical normal strains at the contact surface of stiffener and sheet. The stability equations are solved for general instability under hydrostatic pressure by the method of virtual displacements. The solution used earlier for unstiffened conical shells, which satisfies some of the boundary conditions of simple supports only approximately, is again applied here. The effect of this incomplete compliance with boundary conditions is shown to be negligible by consideration of "boundary work." The solution proposed for stiffened conical shells involves the concepts of "correcting coefficients" and minimization of corresponding "error loads." Typical examples are analyzed and the effect of eccentricity of stiffeners is investigated. Simplified approximate formulas for the critical pressure of frame-stiffened conical shells are also proposed. Author

N65-10818*# Hughes Aircraft Co., Culver City, Calif. Aerospace Group
STUDY OF ADHESION AND COHESION IN VACUUM Summary Report 1 Jul. 1963–30 Jun. 1964
P. M. Winslow, D. Horwitz, and D. V. Mc Intyre 20 Jul. 1964 70 p
(Contract NAS8-11066)
(NASA-CR-59488; P64-62) OTS Prices: HC $3.00/MF $0.75

This is a study of a vacuum chamber and its application for evaluation of the adhesion and cohesion of metal couples. The maximum test criterion was the loading of the materials to 80 percent of their compressive yield strength at various temperatures for 70 000 seconds. The tensile force required to separate two specimens was then measured to determine the extent of adhesion and cohesion. It was found that copper formed a weak bond to itself at temperatures as low as 300° C, and that the 2014 aluminum alloy showed a tendency to bond to itself, to A286 steel, and to René 41 at 300° C. The chromium–nickel stainless steels and the high-nickel alloys had no tendency to bond to themselves or to each other. G.G.

N65-10833 Stanford U., Calif.
AIRCRAFT AND MISSILE STRUCTURES OPERATING AT HIGH TEMPERATURES Final Report
N. J. Hoff 1 Oct. 1963 6 p refs
(Grant AF-AFOSR-138-63)
(AD-424296)

Described is the incorporation of 12 variable transformers into the heating units of a test apparatus for the investigation of the stability of uniformly heated cylindrical shells. A more uniform temperature distribution was insured, and experimental versatility was provided; a new improved method for joining a cylinder along its split seams was developed; and an automatic digital readout system, providing the instantaneous scanning of 25 thermocouple stations, was introduced. An analysis was made to determine the design buckling criteria for shells that are heated along axial strips. G.G.

N65-10866# Naval Ordance Lab., White Oak, Md. Chemistry Research Dept.
A METHOD OF TEST FOR DETERMINING THE COMPRESSIVE PROPERTIES OF FILAMENT WOUND NOL RINGS
S. P. Prosen Oct. 1964 23 p refs
(NOLTR-64-80; AD-605681)

A mechanical fixture that can be used to determine the compressive properties of NOL rings has been developed. Use of the fixture enables the researcher to collect strength data on filament- or roving-wound rings. These data are important in the development of external pressure vessels. This method of test gives compressive strength and modulus values with low coefficients of variation. The data are representative of compressive strength; buckling of the ring specimens has been eliminated. As described herein, the tester can apply a maximum composite loading of 300 000 psi on a standard NOL ring configuration. Author

N65-10881# Gt. Brit. Ministry of Aviation, Mottingham Technical Information and Library Services
TORSION OF A HOLLOW BAR OF REACTANGULAR CROSS SECTION [KRUCHENIE POLOGO STERZHNYA PRYAMOUGOL'NOGO SECHENIYA]
V. I. Yakovleva Sep. 1964 8 p refs Transl. into ENGLISH from Uch. Zap. Azerb. Gos. Univ., Ser. Fiz.-Mat. i Khim. Nauk (USSR), v. 5, 1960 p 3–7
(TIL/T-5488)

A function is presented that conformly describes a ring bounded by concentric circles to an area S, with an outside contour L_1 and an inside contour L_2. The torsion, due to a moment M_k of a prismatic bar with a cross section represented by the area S, is examined. The tension stresses along L_1 and L_2 of the section are determined by calculations, and the ordinates were plotted from the respective contours. It was found that the obtained section has an outer contour L_1 in the form of a rectangle with rounded-off corners and an inner contour L_2 in the form of an ellipse. G.G.

N65-10897# Union Coll., Schenectady, N.Y.
GREEN'S FUNCTIONS FOR JOURNAL BEARINGS
Joseph Modrey Aug. 1964 58 p refs
(Contract Nonr(G)-00028-62)
(AD-604444)

The Green's Function G(Q;D) for a journal bearing is an influence coefficient defining the pressure at point Q by a unit of dimensionless flow strength fed into point D of the bearing clearance. This concept is directly analogous to the fluid mechanics of hydrostatic bearings; hydrodynamic bearings can be pictured as bearings with a distributed external pressurization defined by the self-acting effects, and Green's functions are therefore applicable to this area as well. This report includes the following: (1) the derivation of the fundamental Green's function G_∞; (2) presentation of a noniterative numerical technique for the computation of G_∞; (3) presentation of the coefficients of G_∞ in terms of journal eccentricity and peripheral location of sources; and (4) technique for synthesizing specific Green's functions from the fundamental values. D.S.G.

N65-10913# Goodrich (B.F.) Co., Rialto, Calif. Aerospace and Defense Products
DESIGN INFORMATION FROM ANALYTICAL AND EXPERIMENTAL STUDIES ON FILAMENT WOUND STRUCTURES SUBJECTED TO COMBINED LOADING Final Report, 23 Feb. 1962–1 Jan. 1964
R. A. Harrington Feb. 1964 125 p refs Prepared for Hercules Powder Co.
(ABL-038328; AD-451216)

The failure envelope and elastic constants of glass-reinforced plastic structures were studied so that filament-wound rocket cases could be designed to withstand unsymmetrical loads. Methods were established for calculating skin stresses and allowable combinations of these, and for estimating buckling loads. Analytical methods consisted of the following: (1) prediction of the elastic constants of a single ply by Ekvall's methods;

predicting the elastic constants of a composite laminate made up of many plies by the strain-energy method; (3) determining the stress and/or strain state in the individual ply from the stress and/or strain state in the composite by the use of influence coefficients; and (4) establishing a failure criterion for the composite under loading. Interlaminar layer-distortion energy effects were included, based on knowledge of the ply angle and of the individual ply elastic constants. Testing procedures were worked out, and data were generated for guidance of the analytical methods. Results of the investigation supported the hypothesis that failure of a laminate occurs only after one of its plies is stressed somewhat beyond the failure value for unidirectional material. R.L.K.

N65-10930 National Physical Lab., Teddington (Gt. Brit.) Aerodynamics Div.

A COMPARISON OF THE AERODYNAMIC STABILITY OF A TWIN CYLINDER CONFIGURATION WITH THAT OF A SINGLE CYLINDER

M. A. Packer Jul. 1964 13 p refs

(NPL-Aero-1109)

The aerodynamic stability of a lattice tower supporting two parallel cylindrical steel stacks was investigated. Considered was a model representing only the cylindrical elements of the tower. Because of a large discrepancy between the Reynolds number obtained in the model test and that of the full-scale test, the results were judged not quantitatively applicable to the full-scale tower. A comparison was made between the excitation of the twin cylinder configuration and that of a single cylinder for the low Reynolds number of the tests ($R = 5 \times 10^3$ approx.). This comparison was found to be valid in a qualitative sense for the high Reynolds numbers of the full-scale airflow. It is concluded that the twin-cylinder configuration is more prone than a single cylinder to bending-type oscillations in the wind. G.G.

N65-10940# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

TOWARD THE CALCULATION OF TEMPERATURE STRESS IN COOLED BLADE OF A GAS TURBINE

V. I. Rozenblyum 5 Mar. 1964 11 p refs Transl. into ENGLISH from Inzh. Fiz. Zh. (USSR), v. 4, no. 4, 1961 p 32–37

(FTD-MT-63-212; AD-602567)

A formula is derived for calculation of stresses caused by temperature drop through the thickness of the wall of a blade of arbitrary profile with internal cooling. Author

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N65-10008# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

LUMINESCENCE OF A FRONT OF LOW DETONATION SPEED IN NITROGLYCERINE

G. S. Sosnov, I. M. Voskoboynikov, and A. V. Dubovik 17 Apr. 1964 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 149, no. 3, 1963 p 642–643

(FTD-MT-64-01; AD-605704)

During the luminescence study by a high-speed photographic recorder, utilizing a highly sensitive film of the low-speed detonation of nitroglycerin, the structure of the detonation front was observed and found to be radically different from that observed at high speed. Experiments in shells with various elastic–acoustic characteristics showed that the regime of low-speed detonation is disturbed if the speed of sound in the shell material is less than 2.0 km/sec. The luminescence of the detonation front at low speed depended on the thickness and the different materials used for various shells. G.G.

N65-10057# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ANALYSIS OF THE CHEMICAL COMPOSITION OF A LAMINAR MULTICOMPONENT BOUNDARY LAYER ON THE SURFACES OF BURNING PLASTICS

G. A. Tirskiy *In its* Cosmic Res., Vol. 2, No. 4, 1964 11 Sep. 1964 p 97–136 refs (See N65-10051 01-30)

An analysis is given of the possible chemical composition of gases in a boundary layer on the surfaces of structural phenol–formaldehyde–resin-based synthetic materials burning in a dissociated air-flow. For typical mixtures, which consist of no fewer than 15 to 20 components, a calculation is made to determine the effective diffusion coefficients and the corresponding mass-transfer coefficients in the multicomponent gas mixture. For all self-modeling motions in a multicomponent frozen boundary layer, a closeness (equality) theorem is shown to be valid for the effective diffusion coefficients over the entire thickness of the boundary layer for all components possessing close (equal) molecular weights and gas-kinetic parameters and satisfying the boundary conditions $c_i(\infty) = 0$ or $c_i(0) = 0$. Author

N65-10116 Boeing Co., Seattle, Wash.

AEDC TUNNEL C, BOEING TEST NO. 010, SURFACE ROUGHNESS HEAT TRANSFER AND PRESSURE TEST ON MODEL AD-633M-2 Data Report

D. L. Ayling 4 Dec. 1963 464 p

(Contract AF 33(657)-7132)

(D2-80912; AD-425543)

The AD-633M-2 Model consisted of a basic plate with two side plates, six thermocouple inserts, and five pressure inserts. Tests were conducted at a nominal Mach number of 10 in Tunnel C of the von Kármán Gas Dynamics Facility to experimentally obtain heat-transfer and pressure data for various degrees and types of surface roughness at angles-of-attack. Data presented include temperature records for 77 thermocouples, pressure records for 45 pressure orifices, tunnel parameters, and shadowgraphs. M.P.G.

N65-10152# Joint Publications Research Service, Washington, D.C.

ARRANGEMENT FOR THE DETERMINATION OF THE SPECIFIC HEAT OF LIQUIDS

Ye. T. Vas'kov *In its* Izv. VUZov: Instr. Bldg., No. 4, 1964 27 Oct. 1964 p 205–208 refs (See N65-10126 01-14) OTS: $6.00

A setup is described for the determination of the specific heat of liquids at various temperatures and pressures, and measurements are presented. The method makes use of the direct heating of the liquid in a vacuum adiabatic calorimeter. Author

N65-10197# RAND Corp., Santa Monica, Calif.
DECELERATION AND MASS CHANGE OF AN ABLATING BODY DURING HIGH-VELOCITY MOTION IN THE ATMOSPHERE
Carl Gazley, Jr. Jul. 1964 38 p refs
(P-2900-1; AD-604058)

The factors affecting the dynamics and mass loss of ablating bodies during high-velocity motion are examined. The dynamics and ablation of the body are interdependent, since the rate of mass loss depends on the velocity, and since the deceleration is dependent on the changing ratio of mass to drag area. The classic meteor case, where the flow is assumed to be of the free-molecule type with constant heat transfer and drag coefficients, is reviewed and presented in terms of general dimensionless parameters that allow application to cases other than meteor atmospheric entry. An analytic solution is obtained for the specific variation of the heat-transfer coefficient corresponding to a sphere with laminar convective heating in hypersonic flight at a constant altitude. In this case, the increase of dimensionless heat-transfer coefficient due to decreasing body size can result in a complete loss of mass during the deceleration process. D.S.G.

N65-10274# Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
CALCULATION OF HEATING OF BODIES UNDER THE ACTION OF RADIANT HEAT ON THE BASIS OF THE SIMILARITY THEORY
B. C. D'yachenko 22 Sep. 1964 12 p refs Transl. into ENGLISH from Tr. Mosk. Inst. Inzh. Zheleznodorozhnogo Transp. (Moscow), v. 139, 1961 p 105–110
(RSIC-275; AD-607405)

In this study of the heating of bodies with boundary conditions of a second kind, the assumption was made that the change of a dimensionless heat flow on the surface of a body and also the radiant flow from the surface conform to the law of a hyperbolic tangent. An analytic–empirical investigation method is recommended for the propagation of the determined calculated dependencies of the body with a coefficient of heat conductivity. G.G.

N65-10332# Air Force Office of Scientific Research, Washington, D.C. Office of Aerospace Research
THE INFLUENCE OF INERT AND CHEMICALLY REACTIVE ADDITIVES ON THE MECHANISM OF DETONATION IN GASEOUS MIXTURES OVER WIDE RANGES OF INITIAL PRESSURE AND ADDITIVE CONCENTRATION
Bernard T. Wolfson [1964] 72 p refs Presented at the Spring Meeting of the Western States Sect. of the Combust. Inst., Menlo Park, Calif., 27–28 Apr. 1964
(AFOSR-64-2021; AD-450801)

The effects of helium, argon, and carbon dioxide additives were investigated on the mechanism of detonation in stoichiometric hydrogen–oxygen mixtures over wide ranges of initial pressures and additive concentrations. An attempt was made to determine the validity of the Chapman–Jouguet thermohydrodynamic theory under these conditions. No quantitative conclusions are made about the establishment of complete chemical or thermal equilibrium in the Chapman–Jouguet plane, or about the relative correctness in the real-gas situation of the "frozen" or "equilibrium" product gas sound speed. The detonation velocity was slightly dependent on initial pressure and was critically dependent on mixture composition. No evidence was obtained of the "von Neumann spike" or of an induction zone. Additives were found to retard the rate of attainment of stable detonation in stoichiometric hydrogen–oxygen mixtures. The addition of carbon dioxide had the greatest influence, and argon had the least, on these quantities and on the mechanism of detonation in the gaseous mixtures considered. D.E.W.

N65-10406# Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
A STUDY OF COMBUSTION IN SUPERSONIC STREAMS
Frederick S. Billig (Ph.D. Thesis, Maryland U.) Jul. 1964 70 p refs *Its* Bumblebee Ser. Report.-321
(Contract NOw-62-0604-c)
(AD-447670)

Supersonic combustion of reactive aluminum alkyl fuels has been demonstrated experimentally in two-dimensional ducted combustors adjacent to a flat plate. Fuel was injected from the combustor walls through multiple orifices and ignited spontaneously. Stable supersonic heat release was maintained as evidenced by schlieren and direct motion pictures of the flow field and deduced from static and pitot-pressure measurements in the combustion zone. The results of the ducted combustor tests were correlated with elementary one-dimensional and pseudo-one-dimensional theoretical models of the flow field. This agreement permitted a reasonable determination of combustion efficiency to be made. A theoretical model of constant-pressure heat release on a flat plate in supersonic flow is postulated. Normal force coefficients and specific impulse values are tabulated for a variety of flight Mach numbers and altitudes. The interaction of a vaporizing liquid droplet with a supersonic stream is considered. Additional refinements were made in the existing theories on droplet trajectory to include the influences of a separated zone and the normal component of velocity of the external stream. Author

N65-10434# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
RADIATIVE FLOWS ABOUT CONES AND WEDGES
James J. Der 16 Oct. 1964 32 p refs
(SID-64-1817)

Radiative flows about reentering interplanetary vehicles are studied by the analysis of flows past cones and wedges, using optically thin gray-gas assumptions. A numerical procedure based on the one-layer method of integral relation of Dorodnitsyn is described, and analytical solutions are presented. The analysis is applicable for gases at equilibrium or frozen conditions. Author

N65-10446# Naval Ammunition Depot, Crane, Ind. Research and Development Dept.
A METHOD FOR DETERMINING THE EFFECTIVE EMITTING TEMPERATURE OF A RADIATING BODY
George E. Laramore and Duane M. Johnson 3 Aug. 1964 28 p refs
(RDTR-40; AD-604015)

A method for determining the effective emitting temperature of an incandescent body is decribed. Theoretical derivations and restrictions upon the method are given. The effective emitting temperature of a flame is determined as an illustration of the method. Author

N65-10478# RAND Corp., Santa Monica, Calif.
THE CONTRIBUTION OF GENERALLY-NEGLECTED BAND SYSTEMS AND CONTINUA TO THE ABSORPTION COEFFICIENT OF HIGH-TEMPERATURE AIR
F. R. Gilmore Oct. 1964 25 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-4335-PR; AD-607571)

The molecular band systems and continua that contribute to the absorption coefficient of air between 2000° and 8000° K are discussed. In the vacuum ultraviolet, the major contributors are the oxygen Schumann–Runge continuum, several band systems of nitrogen and nitric oxide, and the photoionization continua of all three molecules. Calculations of the absorption due to the N_2 $b^1\Pi_u \leftarrow X^1\Sigma_g^+$ system agree with measurements on hot nitrogen at 1270 Å. In the near-ultraviolet and visible region, in addition to the band systems of N_2, N_2^+, NO, and O_2 generally considered, the systems of NO_2 and CN are shown to be important. In the infrared, there are many band systems that may contribute. Author

N65-10600 Aeronautical Research Council (Gt. Brit.)
A THEORETICAL SURVEY OF THE POTENTIALITIES OF INSULATION AND INTERNAL COOLING FOR ALLEVIATION OF STEADY KINETIC HEATING
D. J. McCue London, Min. of Aviation, 1964 13 p refs Supersedes RAE-TN-STRUCT-312, ARC-23723
(ARC-CP-744; RAE-TN-STRUCT-312, ARC-23723) HMSO: 3s 6d

An aircraft undergoing steady kinetic heating must be cooled to avoid increase of structural temperature. The amount of internal coolant needed during a flight is reduced, but not eliminated, by the use of external insulation. In a theoretical development it is shown here that under certain conditions, at low altitudes in particular, this combination requires less weight than is necessary using coolant only. This study is a generalization of earlier work, as it includes the effects of radiation and of the variation of thermal conductivity of practical insulating materials. Author

N65-10663# Aerojet-General Corp., Sacramento, Calif. Propellant Research Div.
INVESTIGATIONS OF THE MECHANISM OF DECOMPOSITION, COMBUSTION, AND DETONATION OF SOLIDS Nineteenth Quarterly Technical Operating Report, 1 Jul.–30 Sep. 1964
L. J. Rosen Oct. 1964 16 p refs
(Contract AF 49(638)-851; ARPA Order 24-60)
(Rept.-0372-01-19Q; AD-450504)

Apparent flame strength measurements have been made on the ammonia-nitric oxide and ammonia-nitrous oxide flame reactions in the opposed-jet reactor, at pressures ranging from 100 to 745 torr. The pressure dependencies of the apparent flame strengths of these systems gave overall reaction orders of 1.56 and 2.0 for NH_3-NO and NH_3-N_2O counterflow diffusion flames, respectively. The overall stoichiometry of the NH_3-NO flame near extinguishment can be represented by the following equation.

$$1.5NH_3 + NO \rightarrow 1.25N_2 + 1.25H_2 + H_2O.$$

The volumetric reaction rate for this flame reaction was computed by using Spalding's analysis of the opposed-jet flame. At 1 atm, an apparent flame strength of 0.65 gm/cm^2-sec corresponded to volumetric reaction rate of 2.93 gm/cm^3-sec release rate of 7.22 × 10^3 cal/cm^3-sec. Author

N65-10672 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
THE VARIATION OF $(kpc_p)^{1/2}$ WITH TEMPERATURE IN "PYREX"
Lowell M. Somers Jul. 1961 19 p refs
(CAL-106; AD-279897)

When thin-film resistance gages are used to determine heat-transfer rates in shock-tube or shock-tunnel operations, good accuracy is obtained if the temperature change of the gages is small (less than 30° C). However, when the gages are employed under conditions where the temperature change is much greater than this, the change in the property of the backing material, $\sqrt{kpc_p}$, through which surface heat flux is related to surface temperature, can no longer be neglected. Either the temperature dependence of the individual parameters or that of the product must be known in order to make corrections to measured data. By use of a new technique, the product can be accurately determined as a function of temperature. The product, $\sqrt{kpc_p}$, for the Pyrex backing of thin-film resistance gages has been measured experimentally at elevated temperatures. A comparison with theoretical values is given. Approximate corrections to existing heat-transfer data, using these measurements, have led to improved agreement between experiment and theory in those cases that have been checked. Author

N65-10777# Sud-Aviation, Paris (France)
METHODS AND NECESSARY DATA FOR THE CALCULATION OF A HEAT SCREEN [METHODES ET DONNEES NECESSAIRES POUR LE CALCUL D'UN ECRAN THERMIQUE]
Georges Mounis [1964] 45 p *In* FRENCH Presented at the 14th European Space Symp., Rome, 19–21 Jun. 1964
(Rept- 68.515/64)

On the supposition that the choice of the type of heat shield has already been made in the design of proposed rockets or space vehicles, the problem of defining the dimensions of the shield is considered. It is shown that it is possible to determine precisely the dimensions compatible with the minimum weight required to assure protection, and to quickly check against these dimensions the innumerable modifications in the structural configuration or the heat conditions that occur during the course of the project. This requires methods of calculating thermokinetics, knowledge of heating conditions, and knowledge of the thermal properties of the materials. These factors are considered for shields of the heat sink and ablation types as well as "transpiration" methods. Problems posed by the mechanical resistance of the shields are considered, with particular emphasis on thermal constraints. M.P.G.

N65-10803*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPROXIMATE PREDICTIONS OF THE TRANSPORT OF THERMAL RADIATION THROUGH AN ABSORBING PLANE LAYER
Max A. Heaslet and Franklyn B. Fuller Washington, NASA, Nov. 1964 43 p refs
(NASA-TN-D-2515) OTS Prices: HC $1.25/MF $0.50

The transport of thermal radiation through an absorbing medium bounded by parallel walls is predicted. The walls are heated and are assumed to emit, reflect, and transmit the radiation isotropically. The medium is assumed to be in local thermodynamic equilibrium, and to have radiative characteristics that can be averaged over the entire frequency range. First, relations are given whereby the solution becomes available once the problem associated with the case of opaque, black walls is solved. Second, different methods are employed to derive approximations of radiative flux and temperature distribution through the medium. Simple formulas, of interest in engineering design and analysis, appear as a byproduct of the study. Comparisons are made with previously published numerical results. Author

N65-10805*# National Aeronautics and Space Administration, Washington, D.C.
EXPERIMENTAL INVESTIGATION OF DROPLET VAPORIZATION UNDER CONDITIONS OF HIGH TEMPERATURES

AND PRESSURES [EKSPERIMENTAL'NOYE ISSLEDOVANIYE ISPARENIYA KAPEL' V USLOVIYAKH VYSOKIKH TEMPERATUR I DAVLENIYA]
G. B. Petrazhitskiy Nov. 1964 18 p refs Transl. into ENGLISH from Tr. Odessk. Gos. Univ., Ser. Fiz. Nauk (Odessa), v. 150, no. 7, 1960 p 125–136
(NASA-TT-F-266) OTS Prices: HC $0.50/MF $0.50

This is a study of the vaporization of water droplets, of a 96-percent ethyl alcohol, and kerosene in a gas stream under high-temperature and high-pressure conditions. The Reynolds number for the water droplets was computed from the arithmetic mean diameter of the droplets, without introducing a large error, since in the least favorable case, the actual mean diameter of the vaporizing droplet differed from the arithmetic mean by not more than 3.6 percent. For the other investigated liquids, a smaller magnitude of 2-percent difference was found. G.G.

N65-10810# Bureau of Mines, Berkeley, Calif. Berkeley Thermodynamics Lab.
LOW-TEMPERATURE HEAT CAPACITIES AND ENTROPIES AT 298.15° K OF CRYSTALLINE SILICATES OF BARIUM AND STRONTIUM
William W. Weller and Kenneth Keith Kelly 1964 12 p refs
(BM-RI-6556)

The heat capacities of four crystalline silicates of barium ($BaSiO_3$, Ba_2SiO_4, $Ba_2Si_3O_8$, and $BaSi_2O_5$) and two crystalline silicates of strontium ($SrSiO_3$ and Sr_2SiO_4) were measured over the temperature range from 51° to 298° K. The results were used to evaluate the entropies at 298.15° K. The entropy values were joined with known heats of formation to obtain the free energies of formation of the silicates with respect to their constituent oxides at 298.15° K. Author

N65-10813# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering
HEAT TRANSFER BY COMBINED CONDUCTION AND RADIATION THROUGH A RADIATING GAS
Carl Gene Stolberg (M.S. Thesis) Jun. 1964 106 p refs
(GAM/ME/64-20; AD-604830)

Combined conduction and radiation through a radiating gas between flat plates and concentric cylinders, having gray isothermal surfaces, is investigated. The energy equation for weakly absorbing gases and small differences between surface temperatures is solved analytically for flat plates, and numerically for concentric cylinders. For concentric cylinders, 114 different digital-computer solutions are given. The effects of radius ratio and surface emissivity are illustrated. Finally, an apparatus designed to verify the theoretical calculations, for temperatures less than 2000° R and pressures less than 20 atm, is described. Author

N65-10821*# General Electric Co., Philadelphia, Pa. Missile and Space Vehicle Dept.
THERMAL ENERGY STORAGE RESEARCH AND DEVELOPMENT PROGRAM Final Technical Report, 6 Dec. 1960–1 Dec. 1961
E. F. Batutis [1962] 178 p refs
(Contract NAS5-826)
(NASA-CR-59499) OTS Prices: HC $5.00/MF $1.00

Silicon and a number of refractory oxide mixtures were studied in an investigation of materials having the properties of high heat of fusion and melting temperatures ranging from 1600° to 2100° K. These thermal energy storage (TES) materials were examined for usage in solar collector–thermionic converter electrical power systems employed in space vehicles. Successful refractory oxide mixture containment in refractory metals up to 500 hours was achieved. Adequate containment of silicon was obtained for 100 hours. In a limited directive system study, the oxide materials and silicon were evaluated as part of a solar thermionic electric-power system. Calculated specific system weights ranged from 75 to 127 lb/kW for four of the most attractive oxide materials as compared to 160 lb/kW using silicon. The higher operating temperatures possible by using oxides was the major parameter resulting in specific system weights lower than that calculated for silicon. Author

N65-10826# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio
INTERFEROMETER STUDY OF THE EFFECT OF MASS ADDITION BY TRANSPIRATION ON HEAT TRANSFER FROM A VERTICAL PLATE IN FREE CONVECTION
Darrell A. Schneider (M.S. Thesis) Jun. 1964 83 p refs
(GAM/ME/64-17; AD-604828)

This investigation was restricted to the case of free convection over a heated vertical flat plate with transpiration mass addition accomplished by injection of air into the boundary layer. The analysis was based on data obtained from interferograms of the plate boundary layer and direct measurements of the plate temperature and injection rates. The plate temperature ranged from 100° to 150° F. Injection rates were such that a laminar boundary layer was maintained on the plate. The analysis of the effects of blowing on heat transfer was based on the boundary-layer temperature profile. From these data, the surface heat-transfer coefficient and the associated nondimensional parameters, such as Nusselt, Prandtl, and Grashof numbers, were obtained. D.S.G.

N65-10842# Battelle Memorial Inst., Columbus, Ohio
BURNUP ENHANCEMENT FOR RE-ENTERING NAP SYSTEMS
Ellis L. Foster, Jr. Kirtland AFB, N. Mex., Res. and Technol. Div., Oct. 1963 80 p refs
(Contract AF 29(601)-4939)
(RTD-TDR-63-3054; AD-423411)

The feasibility of enhancing the atmospheric burnup of a ZrH-uranium nuclear fuel upon reentry from orbit by addition of small amounts of alloying elements to the fuel was studied. Thirty-eight different modified fuel compositions were prepared and evaluated. The effects of various additives on fluidity, fabricability, ease of hydriding, hardness, and microstructure of the fuel alloy were determined. Thirty-two separate model-fuel elements representing 25 most promising alloys based upon their apparent fludity and ease of hydriding were exposed to simulated reentry conditions in the exhaust of an oxygen–hydrogen rocket motor. Samples were exposed for 2.5 to 8.0 seconds at a stagnation heat flux level of approximately 370 Btu/(ft^2)(sec). Ablation was noted in all samples. Samples of the unmodified fuel and of fuels modified with additions of vanadium, tungsten, tantalum, aluminum, bismuth, strontium, tin and niobium, antimony, oxygen, nitrogen, and carbon exhibited large weight losses during tests. The latter five modified alloys were believed to have shattered or fractured during tests due to thermal shock. Under the test conditions imposed, the products of ablation of the reference hydride fuel were definitely molten. This was confirmed in detailed examinations of the particles collected downstream during tests, and of the remaining sections of the model elements. A phenomenology of the ablation of the reference hydride fuel was described in some detail. Author

N65-10846# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio School of Engineering
CONVECTIVE HEAT TRANSFER IN THE ENTRANCE REGION BETWEEN PARALLEL PLATES
William M. Pearce, Jr. (M.S. Thesis) Jun. 1964 94 p refs
(GAM/ME/64-13; AD-604826)

The hydrodynamic and convective heat-transfer characteristics of laminar flow in the entrance region between infinite flat plates are investigated. The equation governing the motion of the fluid, the Navier–Stokes equation, is written in terms of the stream function, using the von Mises transformation, and solved numerically on a digital computer. The velocity and pressure gradient distributions that were obtained compare favorably with existing results. The energy equation is solved in a similar manner for four different physical conditions—both walls at a uniform temperature, one wall at a uniform temperature and the other thermally insulated, both walls with a uniform heat flux, and one wall with a uniform heat flux and the other thermally insulated. The temperature profiles and Nusselt numbers are determined for each case, and the results are presented in graphic and tabular form. Author

N65-10899# Naval Weapons Lab., Dahlgren, Va. Warhead and Terminal Ballistics Lab.
AN INVESTIGATION OF THE STEADY STATE EQUATIONS OF THE HOT WIRE INITIATOR
R. L. Montgomery Jun. 1964 23 p refs
(NWL-T-10/64; AD-447280)

The heat-transfer problem of a hot-wire initiator was considered in a previous report. An analytical steady-state solution to the heat-transfer equations given in that report is presented. Data on the temperature distributions in the bridgewire and bead are compared to data computed in the report. The comparison shows the steady-state data, obtained by finite difference methods, to have a maximum error of about 20% and a typical error of 5% or less. Author

N65-10912# Delaware U., Newark
THE ROLE OF INERTS IN HYDROCARBON FLAMES
R. H. Atalla and K. Wohl Sep. 1964 32 p refs Presented at the Tenth Intern. Symp. on Combust., Cambridge, England, 17–21 Aug. 1964
(Contract Nonr-3623(00), Proj. Squid)
(DEL-15-P; AD-606890)

The role of inerts in hydrocarbon flames close to heat sinks has been explored in a spectrophotometric study of low-pressure flat butane–oxygen flames to which were added different amounts of nitrogen while as many other variables as possible were held constant. Measurements of flame temperatures led to the discovery that the presence of an inert can bring about reductions in the heat losses to the sink, which can more than compensate for the effect of thermal dilution. Thus, flames containing nitrogen were found to possess higher temperatures than those of the pure fuel oxidant mixture when burned at the same rate. A theoretical analysis leads to conclusions that are in agreement with the experimental results. Author

N65-10936# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
RESEARCH ON HEAT EXCHANGE IN VACUUM
A. N. Devoyno 20 Feb. 1964 13 p refs Transl. into ENGLISH from Tr. Akad. Nauk Belorussk. SSR (Minsk), no. 11, 1960 p 31–39
(FTD-MT-63-09; AD-602557)

The relation of the coefficient of heat exchange to pressure was received for thermistor TST-0.5 in a range of pressures from atmospheric to 0.01 of mercury. These relations can be used for calculating the thermal processes of thermistors of such type during their work in the upper layers of the atmosphere, and also in vacuum instruments and apparatus. The data received can be applied for calculating thermistor TST-0.5 as a vacuum depth meter. Author

N65-10953*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio
TURBULENT TEMPERATURE FLUCTUATIONS AND TWO-DIMENSIONAL HEAT TRANSFER IN A UNIFORM SHEAR FLOW
Jay Fox Washington, NASA, Nov. 1964 22 p refs
(NASA-TN-D-2511) OTS Prices: HC $0.50/MF $0.50

Correlation equations for statistically homogeneous fluctuations of velocity and temperature at two points in an infinite uniform shear flow are derived with allowance for a temperature gradient in an arbitrary direction in a plane normal to the flow direction. The initially excited isotropic turbulence decays and becomes anisotropic with time. After Fourier transformations are introduced, the resulting spectral equations are solved for the case of weak turbulence wherein triple correlations are neglected compared with double correlations. Spectra of turbulent heat transfer and temperature fluctuation are calculated. For large nondimensional velocity gradients, the thermal eddy diffusivity in the direction normal to the velocity gradient is much larger than that in the direction of the velocity gradient. The thermal eddy diffusivity in the velocity gradient direction tends to equal the momentum eddy diffusivity at large velocity gradients. Author

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N65-10016# Congress. House. Committee on Science and Astronautics
GEOGRAPHIC DISTRIBUTION OF FEDERAL RESEARCH AND DEVELOPMENT FUNDS Report of the Subcommittee on Science, Research, and Development
Washington, GPO, 1964 86 p 88th Congr., 2nd Session, 1964

Geographical distribution data from the eight Federal agencies responsible for 99.2% of the extramural research and development are analyzed, and the distribution patterns are discussed, particularly in regard to inequity. A summary is given of testimony covering the reasons that the research money is so distributed and the methods for making changes in the distribution. Among Government agencies, all but the National Science Foundation considered their function was so mission oriented that it usually was not possible to include geographical location among the factors for determining the allocation of research money. The subcommittee's recommendations for corrective action are given. R.L.K

N65-10208# Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON FRENCH NUCLEAR POLICY AND DEVELOPMENTS
12 Nov. 1964 107 p refs Transl. into ENGLISH of selected articles from FRENCH periodicals
(JPRS-27320; TT-64-51576) OTS: $4.00

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1. THE AIR FORCE IN THE NUCLEAR CONTEXT Andre Martin p 1–17

2. THE LONG-TERM FUTURE OF NUCLEAR POWER R. Gibrat p 18–25

3. POLEMIC ON THE FORCE DE FRAPPE Jean Guichard p 26–66 refs

4. THE LEFT AND DE GAULLE'S NUCLEAR STRIKING FORCE—REPLY TO JEAN GUICHARD Georges Gontcharoff p 67–97

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N65-10210# Iowa State U. of Science and Tech., Ames Ames Lab.

ANNUAL SUMMARY RESEARCH REPORT OF CHEMISTRY, ENGINEERING, METALLURGY, PHYSICS AND REACTOR DIVISIONS, JULY 1, 1963–JUNE 30, 1964

F. H. Spedding et al Sep. 1964 473 p refs

(Contract W-7405-ENG-82)

(IS-900) OTS: $5.50

This is a summary research report of the following subjects: "Chemistry"—physical and inorganic chemistry, analytical chemistry, spectrochemistry, radiochemistry, and structural chemistry; "Engineering"—chemical engineering, ceramic engineering, nuclear engineering, and mechanical engineering; "Metallurgy"—metal preparation, purification and related studies, phase equilibria and thermodynamic properties, behaviors of metals and alloys in a plastic deformation, solid-state investigations and the alloy theory, separation studies, and other investigations; "Physics"—solid-state physics, high-energy physics, and low-energy nuclear physics; "Reactor Utilization"—mechanical equipment and instrumentation, electronic and nuclear instrumentation, calibrations and measurements, and operating regulations, procedures, and limits of the Ames laboratory research reactor; and a "Keyword Index." G.G.

N65-10215# California U., Los Angeles Inst. of Government and Public Affairs

TRANSFORMATION OF NEW KNOWLEDGE FOR ECONOMIC GROWTH

Werner Z. Hirsch Jun. 1964 13 p

(MR-8)

New technological knowledge that is transformed from specialized space and military uses into commercial uses contributes to economic growth by increasing the ability of the economy to produce more of the old, as well as to produce new, goods and services. The need to channel and direct the spillover of new knowledge is demonstrated, and the advantage that the potential user has over the creator in matching bits of new knowledge to end uses is discussed. The role of government in the utilization of new knowledge and the efforts now being made by Government agencies are reviewed. Techniques that could be used to further these efforts are suggested. It is concluded that economic growth from knowledge transformation probably will be great enough to justify the necessary costs; the goal of economic growth is so important that the risk must be assumed. M.P.G.

N65-10477# Planning Research Corp., Los Angeles, Calif.

TECHNIQUES FOR PREDICTING RAND COSTS AND SCHEDULES OF AUTOMATIC FLIGHT CONTROL SYSTEMS; VOLUME 1, AERODYNAMIC VEHICLES Technical Documentary Report, Sep. 1962–Aug. 1963

H. M. Dye Wright-Patterson AFB, Ohio, AF Flight Dyn Lab., Aug. 1964 119 p refs

(Contract AF 33(657)-7202)

(R-378; RTD-TDR-63-4064, Vol. 1; AD-607283)

An empirical approach is taken, using relevant historical data on 25 automatic flight control systems. The predictive methodology is formulated using two types of statistical estimation models. The first model is derived with the underlying assumption that development cost and development time are random variables that are normally distributed. The second model also treats development cost and time as random variables, but no assumptions are made on their distributions. The resultant predictive techniques are expressed as simple algebraic equations that can be evaluated to obtain cost and time estimates for a proposed flight-control system. The principal parameters that are necessary to evaluate the prediction equations are gross functional and design complexity of the automatic flight control system, performance and airframe characteristics of the vehicle, and scope and calendar data of the development program. Author

N65-10573# Lockheed Missiles and Space Co., Sunnyvale, Calif.

VALUE ENGINEERING: AN ANNOTATED BIBLIOGRAPHY, 1961–JUNE 1964

Peter R. Stromer, comp. Aug. 1964 32 p

(LMSC-4-11-64-6; SB-64-16)

Value engineering has been defined as a procedure making use of the best available techniques common to cost reduction, reliability, quality control, industrial engineering, and operations research. The value engineer or value analyst seeks out all items affecting costs that can be eliminated or modified while maintaining or improving functional performance of particular products or systems. Period of literature coverage is 1961 through June 1964. A subject index is included. Author

N65-10829# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ALL UNION CONFERENCE ON THE TECHNIQUE OF INFRARED RADIATION AND ITS UTILIZATION IN SCIENCE AND INDUSTRY

V. Kotesovec 3 Aug. 1964 10 p Transl. into ENGLISH from Jemna Mechanika a Optika (Czechoslovakia) v. 8, no. 2, 1963

(FTD-TT-64-211/1+2; AD-603948)

The tasks of the conference were to acquaint its participants with the development and present status of infrared technology, to point out its possibilities in various branches of science and technology, and to reveal the problems associated with further development and utilization of the infrared technique. After a few general review papers, the participants formed the following working sections: (1) physics of infrared radiation; (2) elements of infrared radiation; (3) equipment technique; (4) natural sciences and medicine; and (5) heating with infrared radiation. Briefs of the discussions held by each section were used in compiling this general report. M.P.G.

N65-10933# Joint Publications Research Service, Washington, D.C.

TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY NO. 121

16 Nov. 1964 97 p refs Transl. into ENGLISH of Articles from Chinese periodicals
(JPRS-27372; TT-64-51628) OTS: $3.00

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—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

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